

SERVICE MANUAL
MODEL 1701/1702 MONITOR

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C1701/C1702 COLOR MONITORS PRODUCT SPECIFICATION

GENERAL DESCRIPTION

The C1701 and C1702 are quality, high resolution color monitors, designed to maximize the video capabilities of your Commodore Computer. They give you a superior color picture that enhances your computing experience and are completely compatible with all Commodore equipment.

SCREEN SIZE

13 Inch (screen measured diagonally). NTSC color standard

DISPLAY

40 Columns x 25 lines

RESOLUTION

1000 Characters per screen

CONTROLS

Color, tint, brightness, contrast, volume, vertical hold and horizontal hold

AUDIO

Built-in audio amplifier and speaker

INPUTS

Chrominance, luminance, composite video and audio

OTHER FEATURES

Video cassette recorder compatible (1V p-p, 75 Ohms)

COMPUTERS

Commodore 64, VIC 20, Plus/4 and C16

POWER REQUIREMENTS

120 Volts, 60 Hz, 0.85 Amps

POWER CONSUMPTION

87 Watts

All specifications subject to change without notice.

SAFETY PRECAUTIONS

1. This product contains special designed circuits and components that were designed for safety purposes.

For continued protection, changes should not be made to the original design unless authorized in writing by the manufacturer. Replacement parts must be identical to those used in the original circuits. Service should be performed by qualified personnel only.

2. Alterations to the design or circuitry of this receiver should not be made. Any design alterations or additions will void the manufacturer's warranty and will further relieve the manufacturer of responsibility for personal injury or property damage resulting therefrom.
3. Many electrical and mechanical parts in MONITOR sets have special safety-related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in the parts list of this service manual. Electrical components having such features are identified by shading on the schematics and by (*) on the parts list in this service manual. The use of a substitute replacement which does not have the same safety characteristics as the recommended replacement part shown in the parts list may create shock, fire, or other hazards.
4. If any repair has been made to the chassis, it is recommended the the B_1 setting be checked or adjusted (See ADJUSTMENT OF B_1 VOLTAGE).
5. The high voltage applied to the picture tube must conform with that specified in this service manual. Excessive high voltage can cause an increase in X-Ray emission, arcing and possible component damage, therefore operation under excessive high voltage conditions should be kept to a minimum, or should be prevented. If severe arcing occurs, remove the AC power immediately and determine the cause by visual inspection (incorrect installation, cracked or melted high voltage harness, poor soldering, etc.). To maintain the proper minimum level of soft X-Ray emission, components in the high voltage circuitry including the picture tube, must be the exact replacements or alternatives approved by the manufacturer of the complete product.
6. Do not check high voltage by drawing an arc. Use a high voltage meter or a high voltage probe with a VTVM. Discharge the picture tube before attempting meter connection by connecting a clip lead to the ground frame and connecting the other end of the lead through a 10k Ω 2W resistor to the anode button.
7. When service is required, observe the original lead dress. Extra precaution should be given to assure correct lead dress in the high voltage circuit area. Where a short circuit has occurred, those components that indicate evidence of overheating should be replaced. Always use the manufacturer's replacement components.

SAFETY PRECAUTIONS (Continued)

8. ISOLATION CHECK (SAFETY FOR ELECTRICAL SHOCK HAZARD)

After re-assembling the product, always perform an isolation check on the exposed metal parts of the cabinet, screwheads, cable jacks, controls shafts, etc., to be sure the product is safe to operate without danger of electrical shock.

(A) DIELECTRIC STRENGTH TEST

The isolation between the AC primary circuit and all metal parts exposed to the user, particularly any exposed metal part having a return path to the chassis should withstand a voltage of 1,100V AC (r.m.s.) for a period of one second.

This method of test requires test equipment not generally found in the service trade.*

(B) LEAKAGE CURRENT CHECK

Plug the AC line cord directly into the AC outlet (do not use a line isolation transformer during this check). Using a "Leakage Current Tester", measure the leakage current from each exposed metal part of the cabinet, particularly any exposed metal part having a return path to the chassis, to a known good earth ground (water pipe, etc.). Any leakage current must not exceed 0.5mA.

*** ALTERNATE CHECK METHOD**

Plug the AC line cord directly into the AC outlet (do not use a line isolation transformer during this check). Use an AC voltmeter having 1,000 ohms per volt or more sensitivity in the following manner. Connect a 1500 Ω 10W resistor paralleled by a 0.15 μ F AC-type capacitor between an exposed metal part and a known good earth ground (water pipe, etc.).

Measure the AC voltage across the resistor with the AC voltmeter.

Move the resistor connection to each exposed metal part, particularly any exposed metal part having a return path to the chassis, and measure the AC voltage across the resistor. Now, reverse the plug in the AC outlet and repeat each measurement. Any voltage measured must not exceed 0.35V AC (r.m.s). This corresponds to 0.5mA AC (r.m.s.).

CAUTION:

When troubleshooting, with power applied, use an isolation transformer and confirm that the CRT earth wire is connected to the CRT socket board and the chassis.

ADJUSTMENTS — PURITY, CONVERGENCE AND WHITE BALANCE

PICTURE TUBE

The picture tube is a precision in-line gun type. For this picture tube, dynamic convergence is carried out by a precision deflection yoke which eliminates the use of a convergence yoke and a convergence circuit. The adjustment of the picture tube is therefore made easier as only the adjustment of static convergence by using a magnet is enough. The deflection yoke and purity/convergence magnets assembly has been set at the factory and requires no field adjustments.

However, should the assembly be accidentally jarred or tampered with, some or all adjustment may be necessary.

COLOR PURITY & VERTICAL CENTER

Loosen yoke retaining clamp (Fig. 2-1). With a sharp knife, cut between the picture tube and the wedge. Remove wedges completely and clean off dried adhesive from the picture tube. PAINT is used to lock the tabs of the purity/convergence magnet assembly in place (Fig. 2-1). The paint must be removed with the end of a screwdriver before any adjustments are attempted.

1. Inject a Video Signal (RASTER) to the Video input terminal.
2. Let the purity tabs come in line horizontally as is shown in Fig. 2-3. A long tab should be in the same direction as the other short tab.
3. Move the yoke slowly backward.
4. Turn the green cut-off control to maximum and the red and blue cut-off controls to minimum. Then adjust the screen control so that the green band can be seen best. (Fig. 2-4)
5. Rotate the two tabs in the opposite direction with them kept at an angle. Move them in either direction so that the green band is centered on the picture tube.
6. Check the vertical center position by displaying a horizontal line. If incorrect, bring it to the center by rotating the two tabs, kept at an angle, together in either direction. (Fig. 2-5, 2-6)
7. Repeat steps 5 and 6 alternately until the green band and the vertical centre are in line.
8. Move the yoke slowly towards the bell of the tube so that the whole surface of the picture tube is filled with a pure green raster.
9. Turning the red cut-off control to maximum and the green cut-off control to minimum, check for pure red raster.
10. Turning the blue cut-off control to maximum and the green cut-off control to minimum, check for pure blue raster.
11. Secure yoke retaining clamp (do not install wedges at this time).

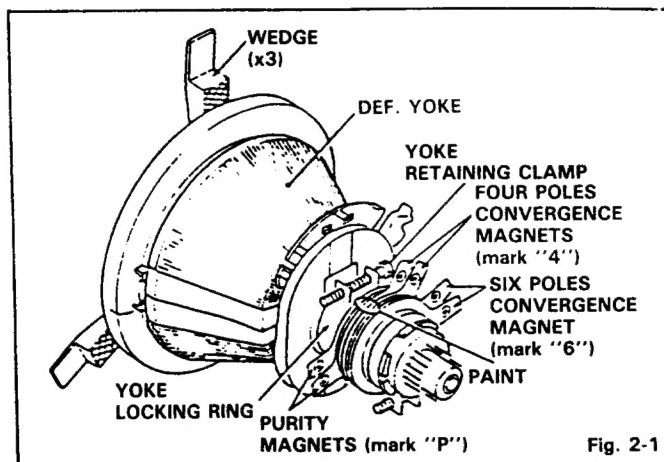


Fig. 2-1

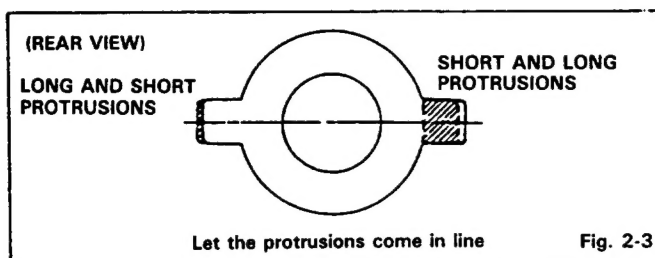


Fig. 2-3

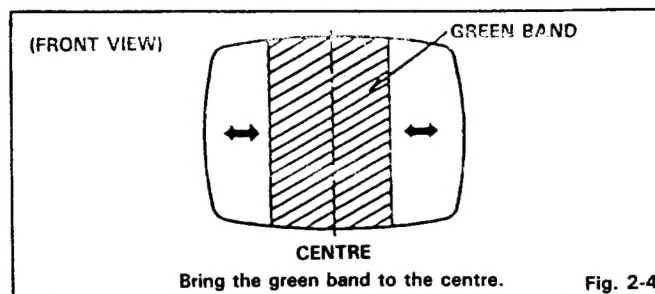


Fig. 2-4

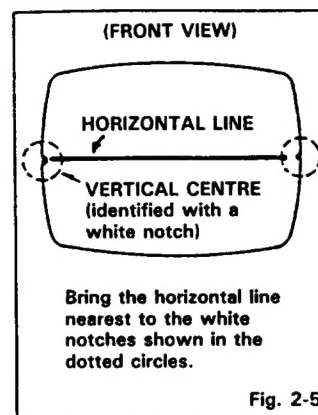


Fig. 2-5

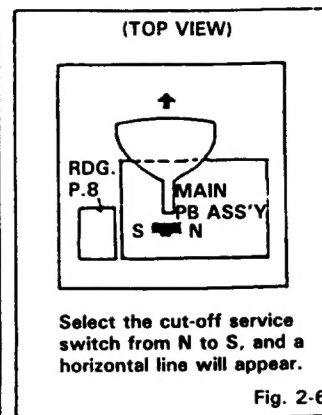


Fig. 2-6

STATIC CONVERGENCE & DYNAMIC CONVERGENCE

Static convergence is achieved by four magnets located on the neck, nearest the base of the picture tube. The front pair of magnetic rings (closest to the purity tabs) are adjusted to converge the red and blue crosshatch lines.

The rear pair of convergence rings (closest to the base of the picture tube) are adjusted to converge the magenta (Red/Blue) and green crosshatch lines.

Dynamic convergence is achieved by tilting the deflection yoke, Up-Down and Left-Right.

1. Inject Video Signal (CROSSHATCH) to the Video input terminal and adjust BRIGHTNESS and CONTRAST control for distinct pattern.
2. Adjust the convergence around the edges of the picture tube tilting the yoke, up-down and left-right. Temporarily install one wedge at the top of the yoke. (Fig. 2-9, 2-10, 2-11)
3. Rotate the front pair of tabs as a unit to minimize the separation of the red and blue lines around the center of the screen. To adjust the convergence of red and blue, vary the angle between the tabs.
4. Rotate the rear pair of tabs as a unit to minimize the separation of the magenta and green lines. (Fig. 2-8)
5. Adjust the spacing of the rear tabs to converge the magenta and green lines.
6. Apply paint to fix 6 magnets.
7. Remove the wedge installed temporarily on the yoke.
8. Tilting the angle of the yoke up, down and sideways, adjust the yoke so as to obtain the circumference convergence. (Fig. 2-10, 2-11)
9. Insert three wedges to the positions as shown in Fig. 2-12 to obtain the best circumference convergence.
10. Secure wedges in position with the adhesive backing provided or use a non-conductive silicon/rubber compound.
11. White balance adjustment (Black & White tracking) can now be performed.

WHITE BALANCE ADJUSTMENT

(Black and White Tracking)

1. Inject a Video Signal (RASTER) to the Video input terminal.
2. Set the red and green drive controls for their mechanical center.
3. Turn the red, green and blue cut off controls and the screen control fully counterclockwise.
4. Change the service switch as shown in Fig. 2-6, to the "S" position.
5. Turn screen control slowly clockwise until a very faint horizontal line appears.
6. Turn the cut off control of the color which has appeared first, clockwise by about 10° and then adjust the screen control again so that the color may shine faintly.
7. Turn the other color cut off controls slowly clockwise until a reasonable white line appears.
8. Return the service switch to normal (N) position. (Fig. 2-6)
9. Adjust the red and green drive controls for best white highlights.

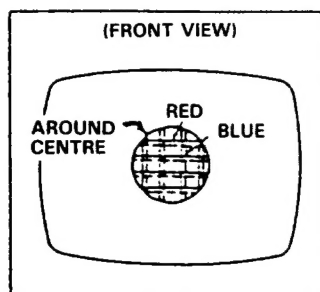


Fig. 2-7

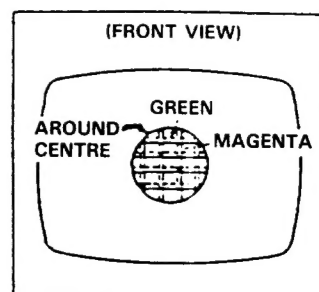


Fig. 2-8

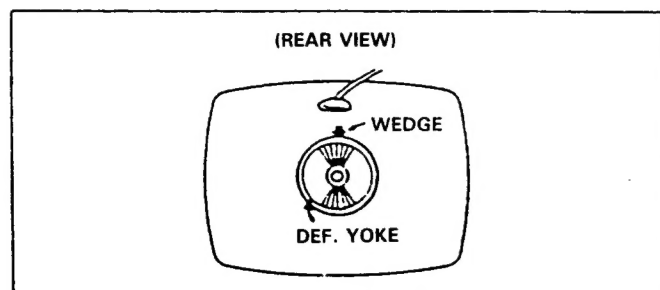


Fig. 2-9

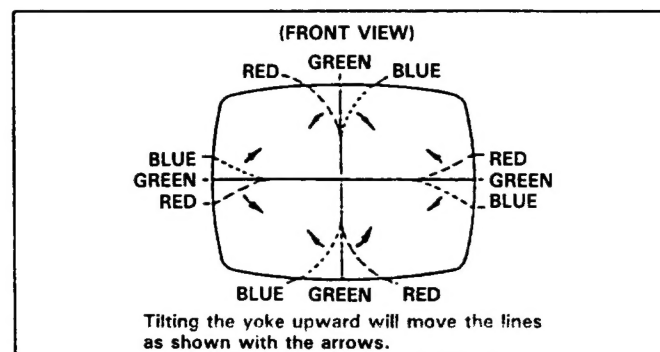


Fig. 2-10

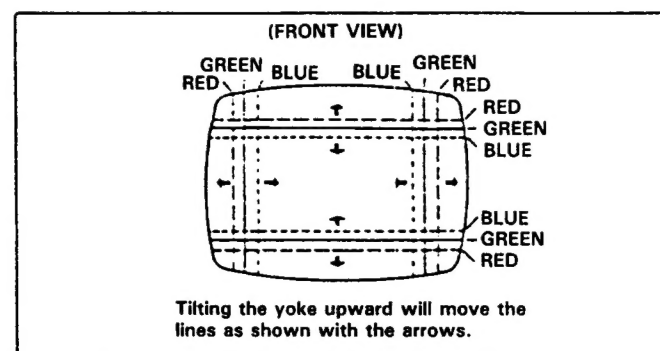


Fig. 2-11

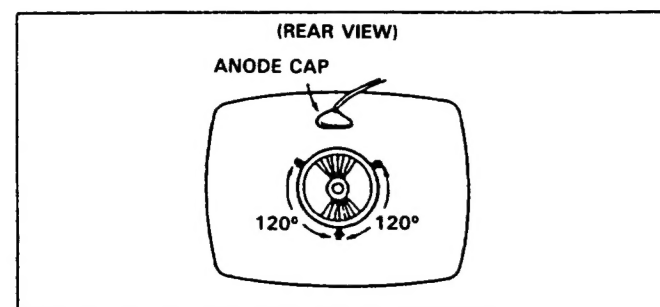


Fig. 2-12

NOTE: 1702 locations in ().

B₁ VOLTAGE — Inject a video signal

1701 (110V)

Regulate VR, R109, for B₁ adjustment so that Dc voltage between TP-91 and earth is 110 volts.

1702 (125V.)

Confirm that the voltage at TP-94 and IC901 pin 4 is 125 volts.

NOTE: Meter should be periodically calibrated at 20K ohms/volt.

FOCUS

Adjust the FOCUS control for best overall definition and picture detail at normal brightness and contrast.

VERTICAL POSITION

Adjust the V. center VR R428 (R429) to the optimum vertical picture position.

VERTICAL HEIGHT AND LINEARITY

1. Display a pattern which allows easy confirmation of symmetry (such as a circle or crosshatch).
2. Reduce the vertical size with the V. HEIGHT VR.
3. Adjust the vertical linearity with the V. LIN. VR.
4. Readjust the vertical height, so that the picture extends to normal size.

HORIZONTAL WIDTH

Adjust H. WIDTH control coil L503 (L522) by turning it with a hexagonal adjusting bar only if RIGHT and LEFT sides of picture can't be seen.

HORIZONTAL OSCILLATOR

1. Set the H. FREQ. VR to the mechanical center position.
2. Connect a jumper clip between TP-33A and TP-33B.
3. While rotating the H. FREQ. VR, R504, keep the picture stationary or slowly moving.
4. Remove the jumper wire.
5. Make sure that the set maintains horizontal sync, when signals are switched.

SUB TINT AND SUB COLOR

1. Display a picture and set the tint and color VRs on the control panel to the central click position.
2. Adjust the sub tint VR, R305 and sub color VR, R303 for the optimum display.

SUB CONTRAST AND SUB BRIGHT

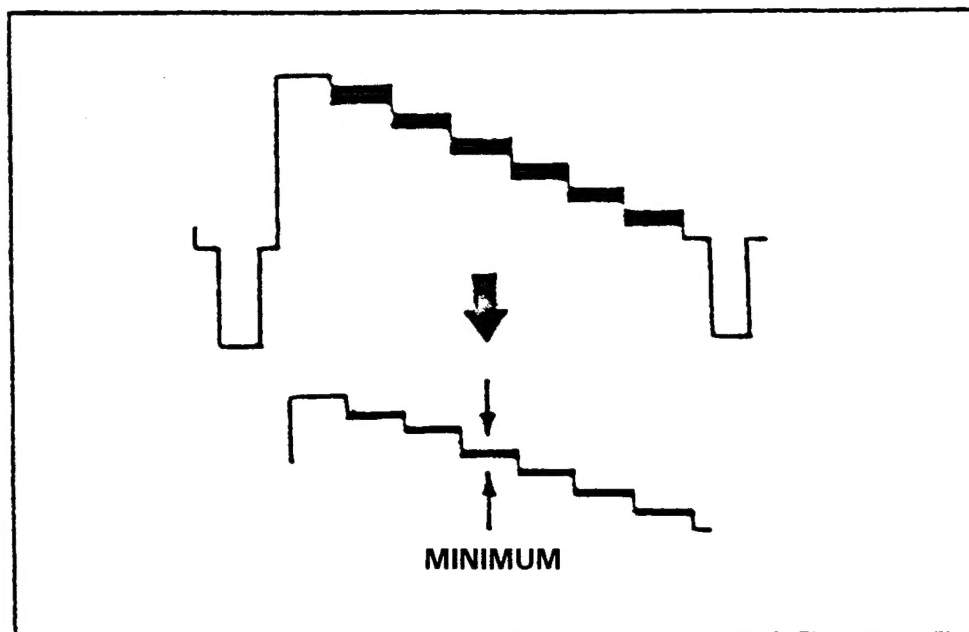
1. Display a picture and set the contrast and bright VRs on the control panel to the center click positions.
2. Adjust the sub contrast VR, R209 and sub bright VR, R22 (R863) for optimum display.

COLOR SYNC

1. Display a color video signal.
2. Connect jumper clips between TP-40 and earth (TP-E) and between TP-51 and IC301 pin 15 (TP-51B).
3. Use a non-metallic screwdriver to turn trimmer capacitor C308.
4. Adjust so that the rolling color stripes become thick and the rolling slows or stops.
5. Remove jumper clips.
6. Confirm that color sync is not disrupted when signals are switched.

3.58 MHz TRAP

1. Receive a Video Signal into the Video input terminal.
2. Connect oscilloscope probe to DL201 (Delay Line) output side.
3. Turn the core of T201 so that that 3.58MHz signal is minimized.

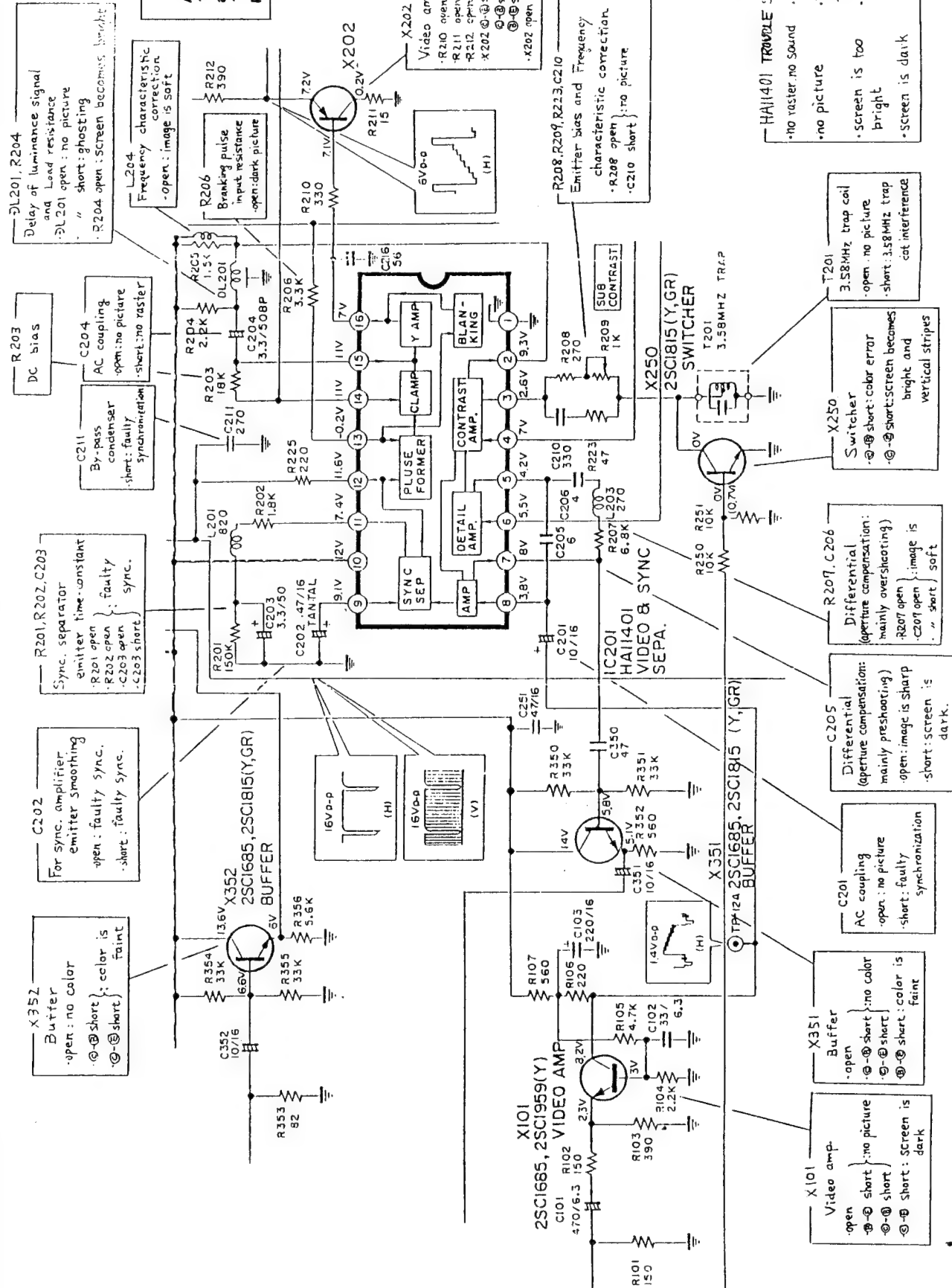


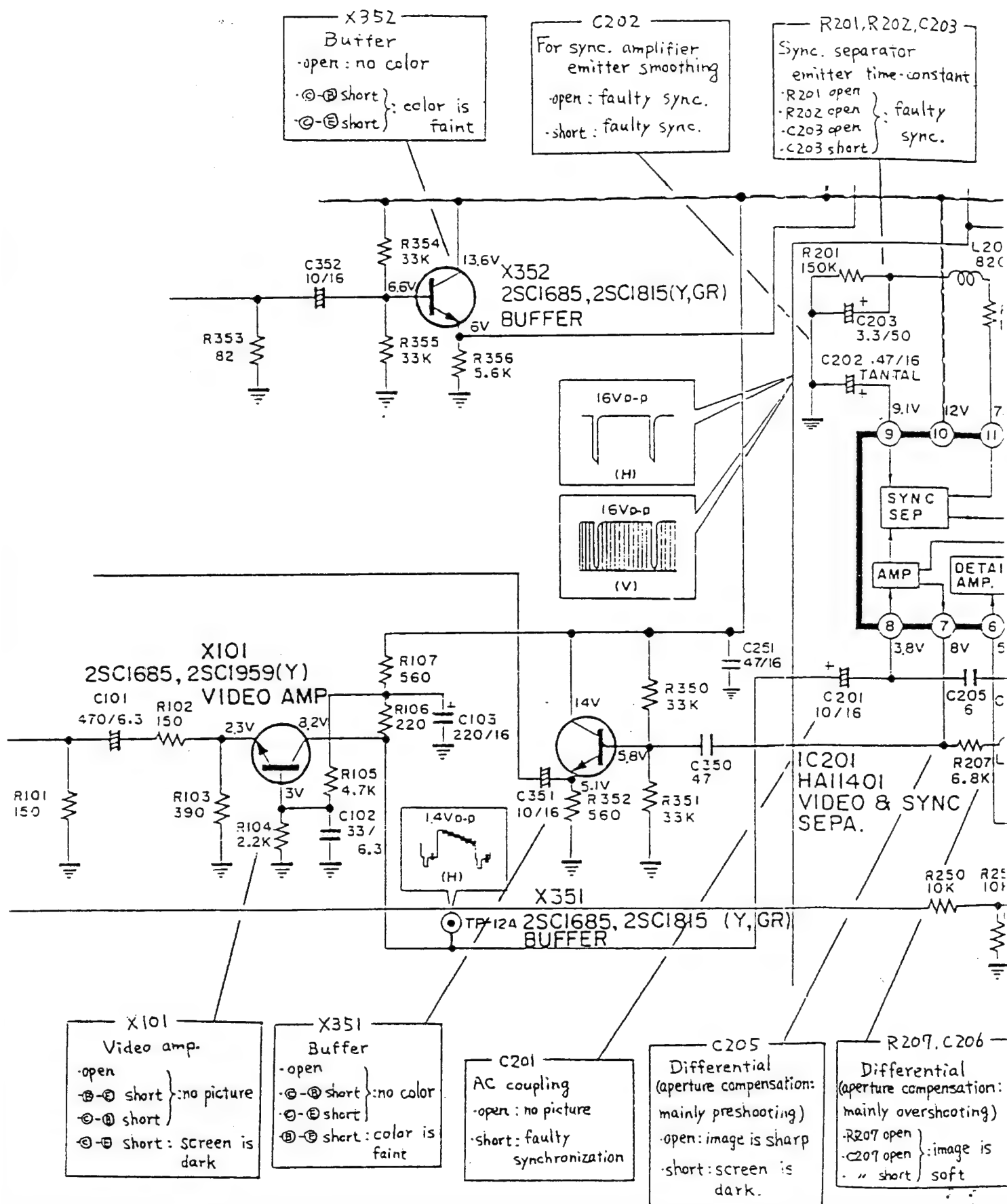
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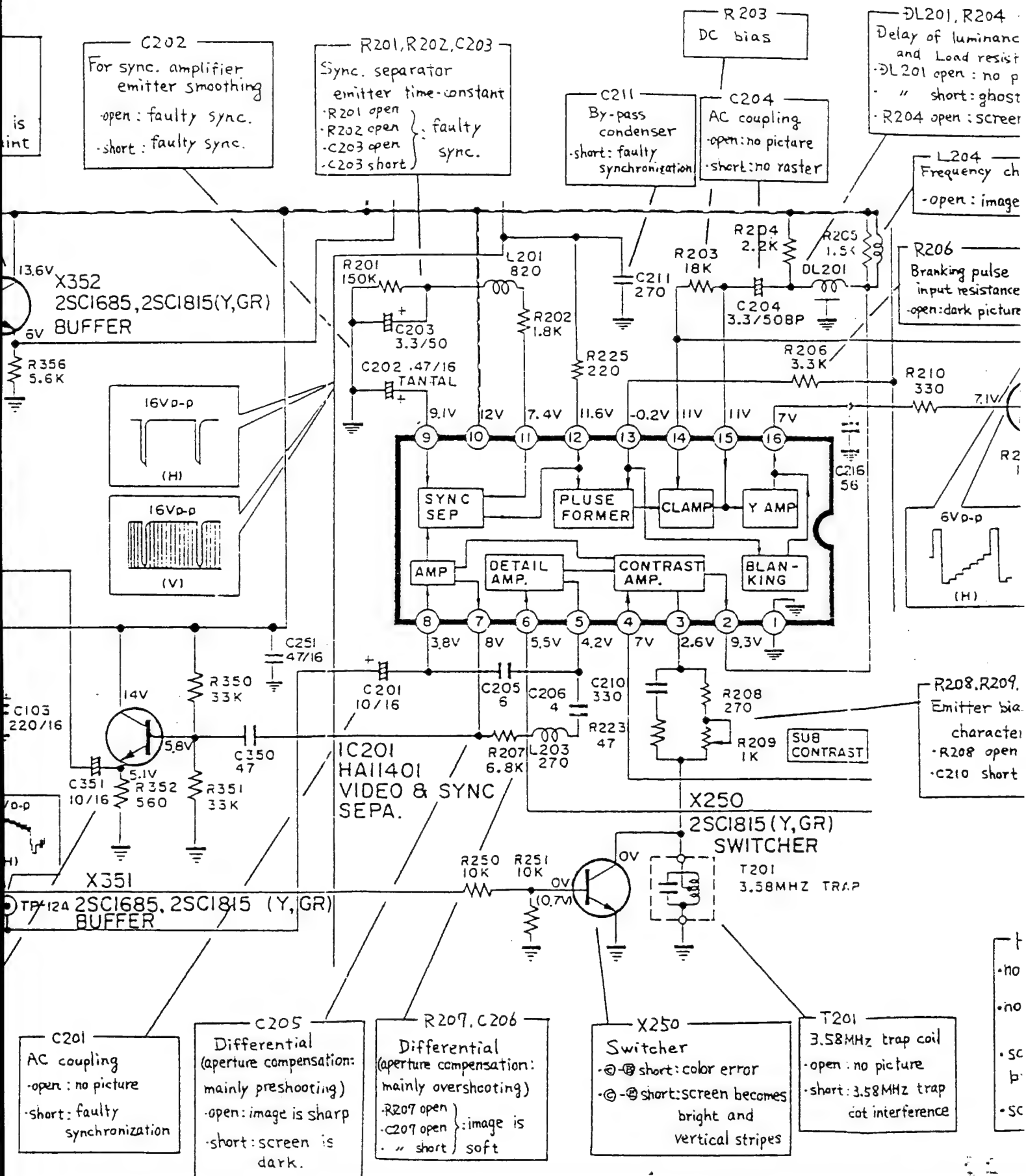
VIDEO CIRCUIT

CIRCUIT NOTES

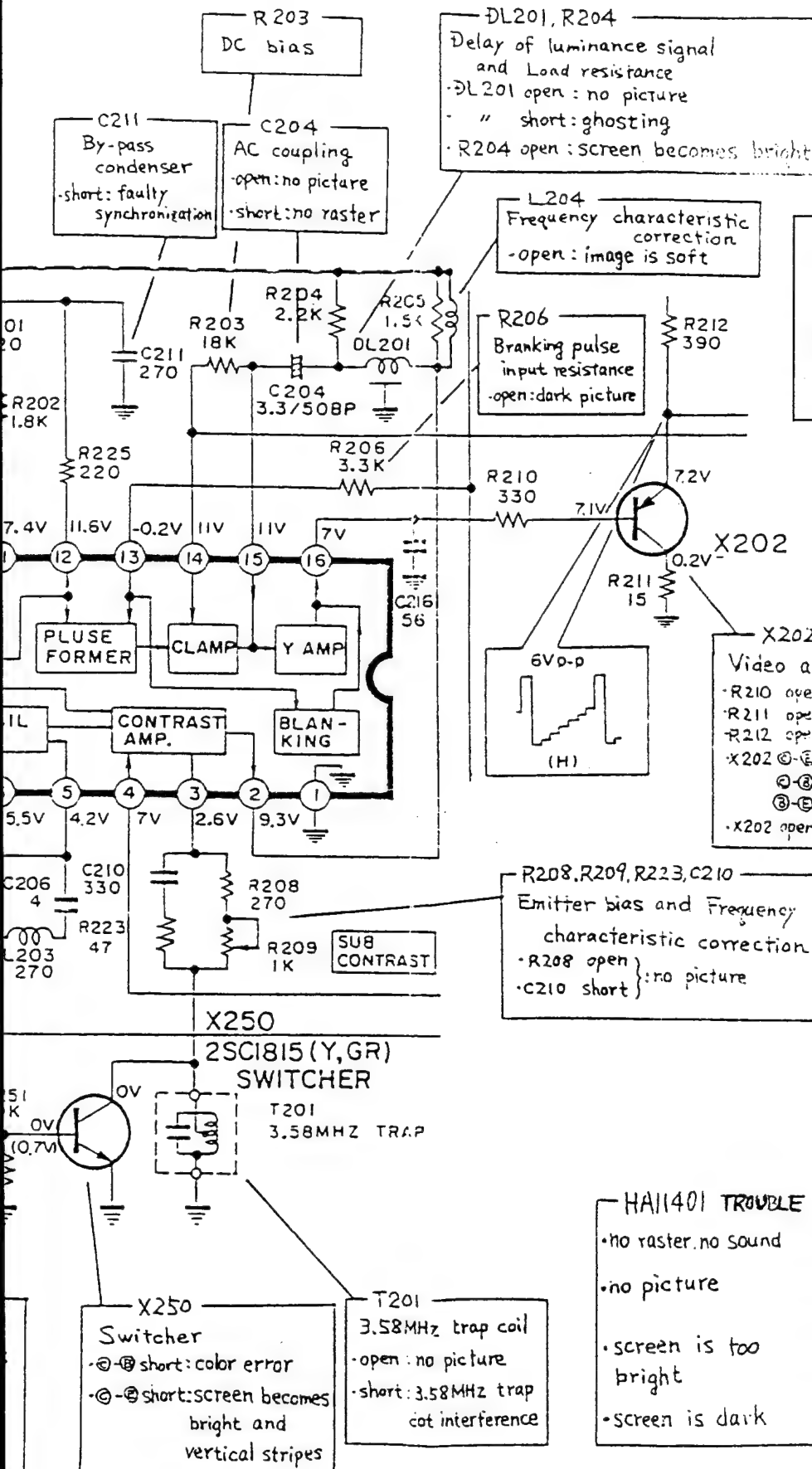
Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.







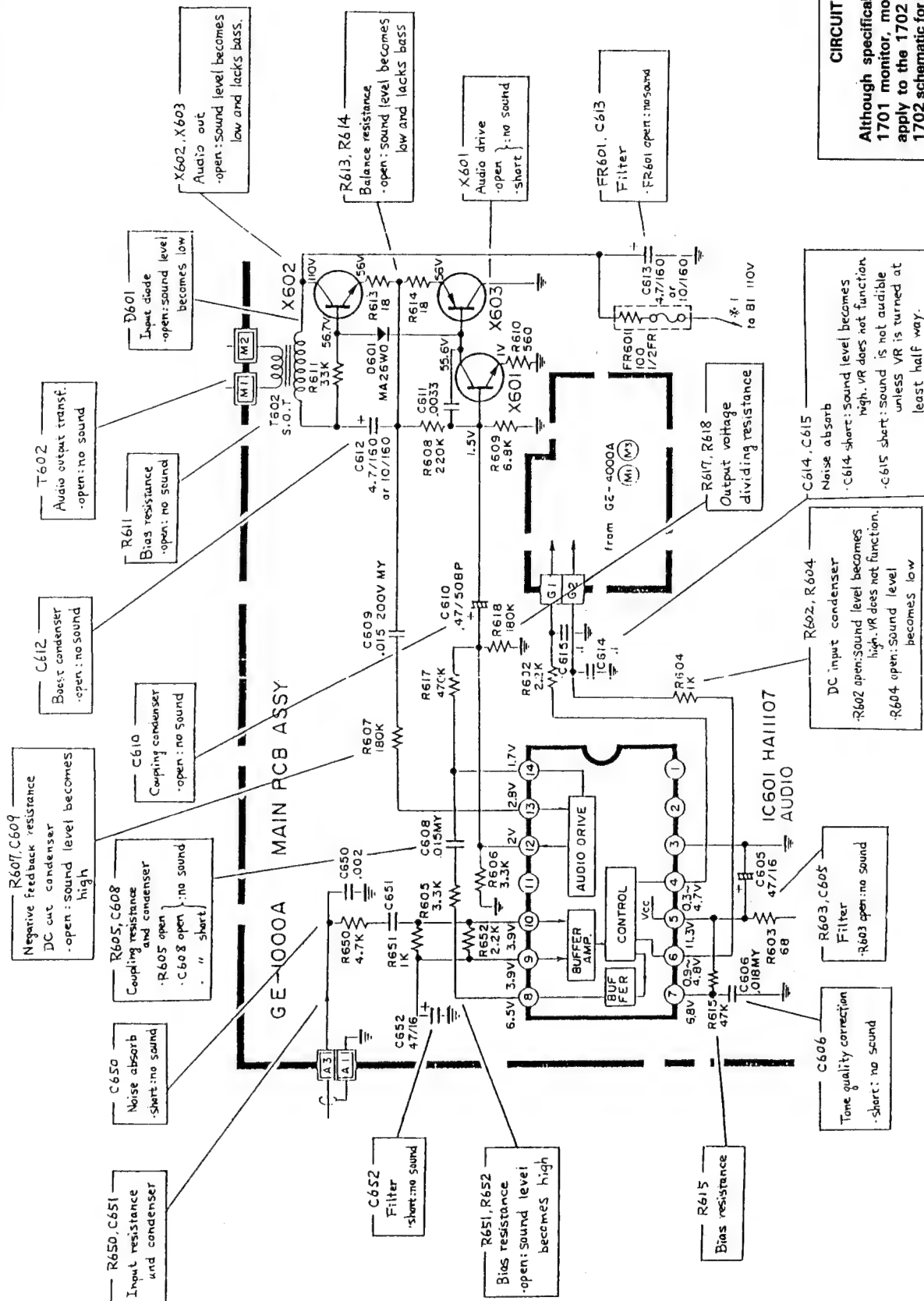
VIDEO CIRCUIT



CIRCUIT NOTES

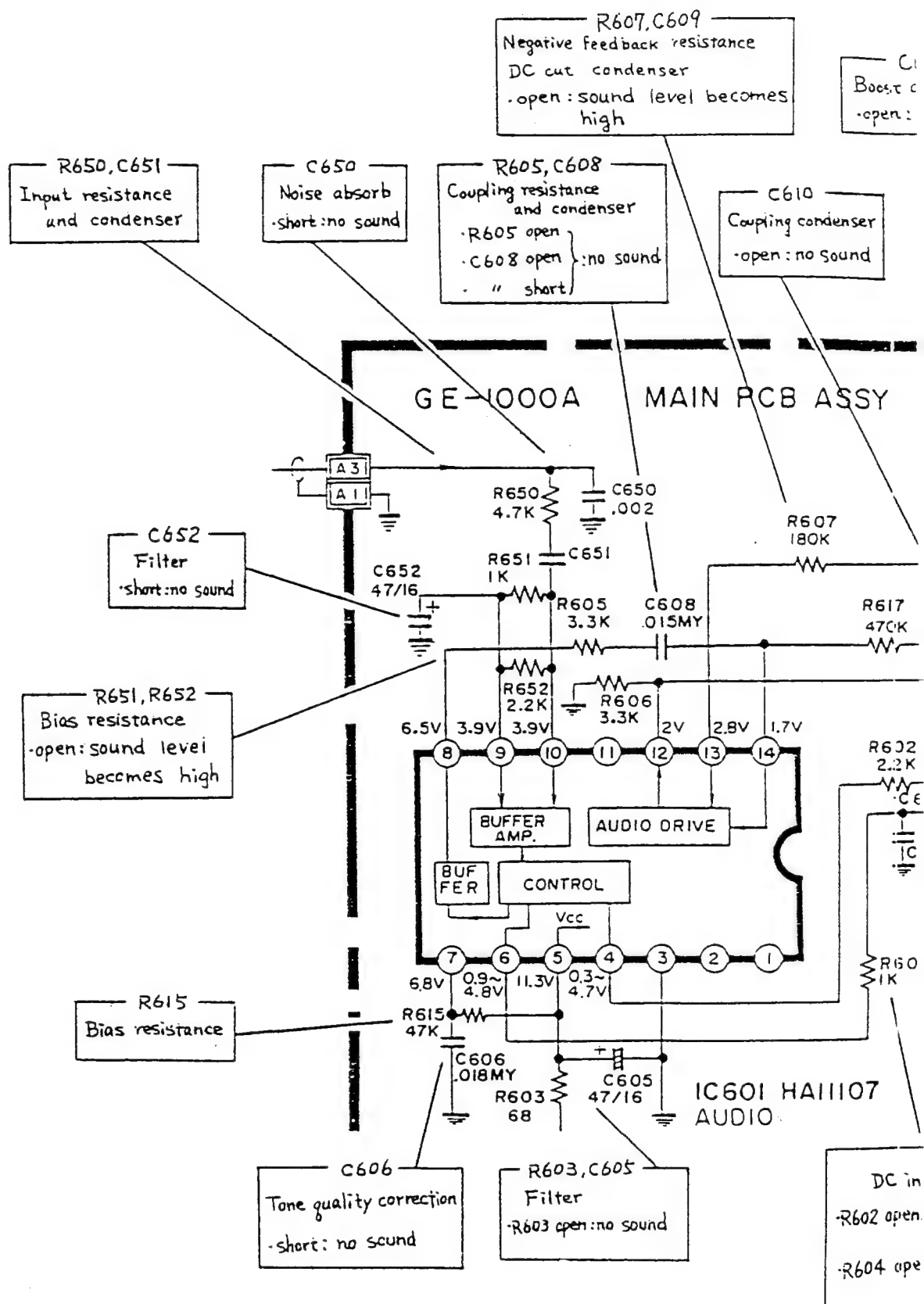
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AUDIO CIRCUIT

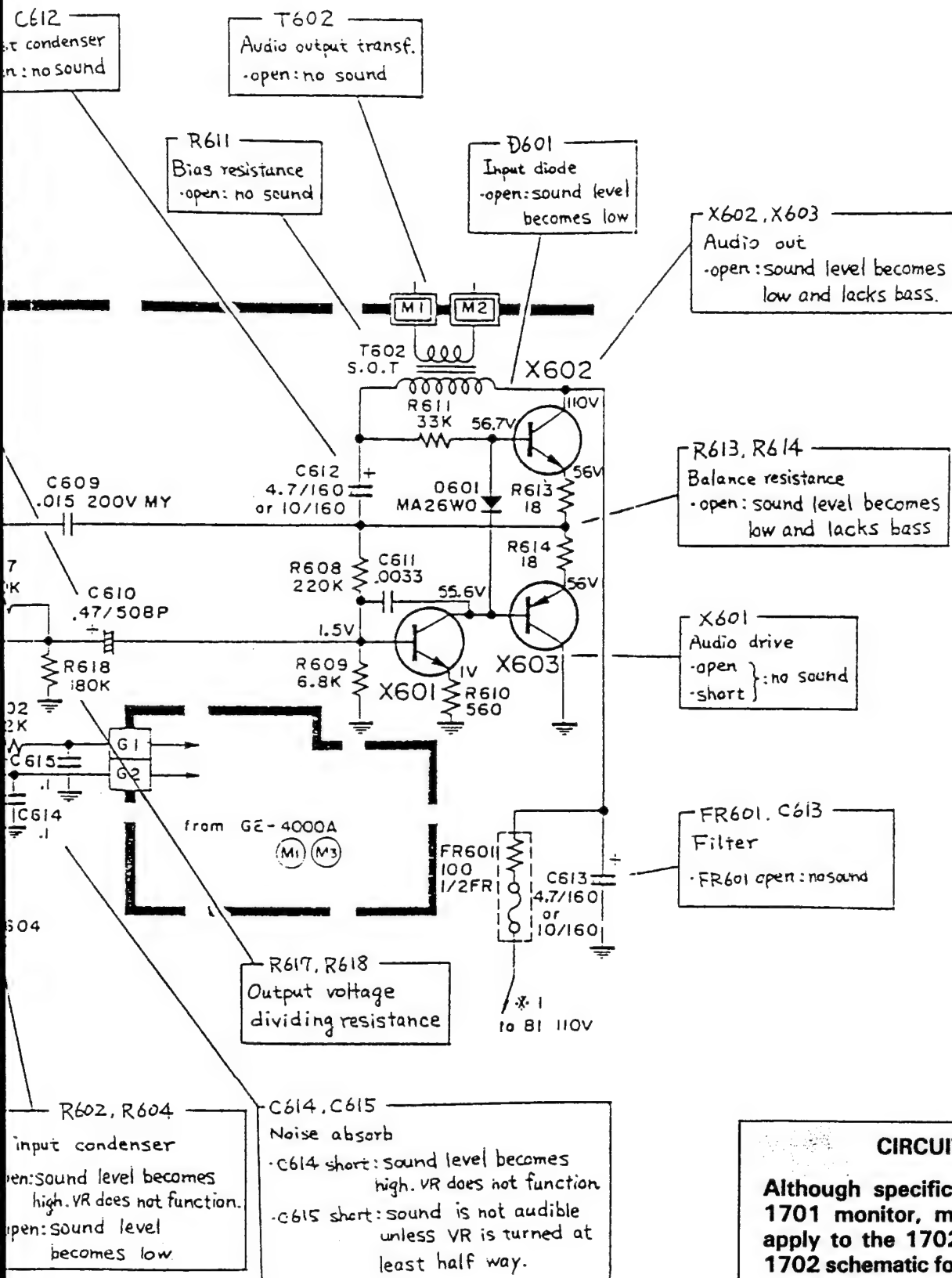


CIRCUIT NOTES

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AUDIO CIRCUIT



CIRCUIT NOTES

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COLOR DEM. CIRCUIT

X301, R315, R316, R317
R318, R321, C316

Super-scene control

- R315 open: contrast becomes weak
- R316 open: contrast becomes weak
- R317 open: contrast becomes weak
- R318 open: contrast becomes weak
- C316 short: contrast becomes weak
- X301 open: contrast becomes weak

CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

D302 Beam limiter diode
-short: brighter

R310, R311, R312 IC protection resistor
-R310 open: yellow picture
-R311 open: cyan picture
-R312 open: magenta picture

D303 ~ D308 Protection of IC from CRT sparking
-D303 short: blue picture
-D304 short: red picture
-D305 short: green picture

High frequency filter
-L351 open: yellow picture
-L352 open: cyan picture
-L353 open: magenta picture

C313, C314, R313, R314 APC smoothing
-C313 short: no color
-C314 short: no color
-R313 open: no color
-R314 open: no color

Y301, C308, R309, C309 3.58MHz filter
-Y301 open, short: no color
-C308 open: no color
-R309 open: no color
-C309 open, short: no color

C307, R307, R308 For phase shift
-C307 short: screen becomes bright but no color obtained
-C307 open: no color
-R307 open: no color
-R308 open: no color

D301 For noise prevention
-short: color error

C306 Differentiates sync signal, and delays phase of pulse.
-open: no picture
-short: no picture
dark raster

HA11247 TROUBLE SYMPTOM OF PRESUME
-no picture
-only monochromatic
-faulty tint
-color noise
-color error
-no color, color fade away
-no monochromatic
-faulty color sync.
-color beat
-etc...

C301 Color signal coupling
-open: no color
-short: no color

T301 BP take-off trans.
-open: no color
-short: no color

R301 Dumping resistance
-open: color error
-short: color error

C302 By-pass condenser
-open: color becomes dark
-short: no color

R323 Emitter resistance

C304 Coupling condenser
-open: no color
-short: no picture

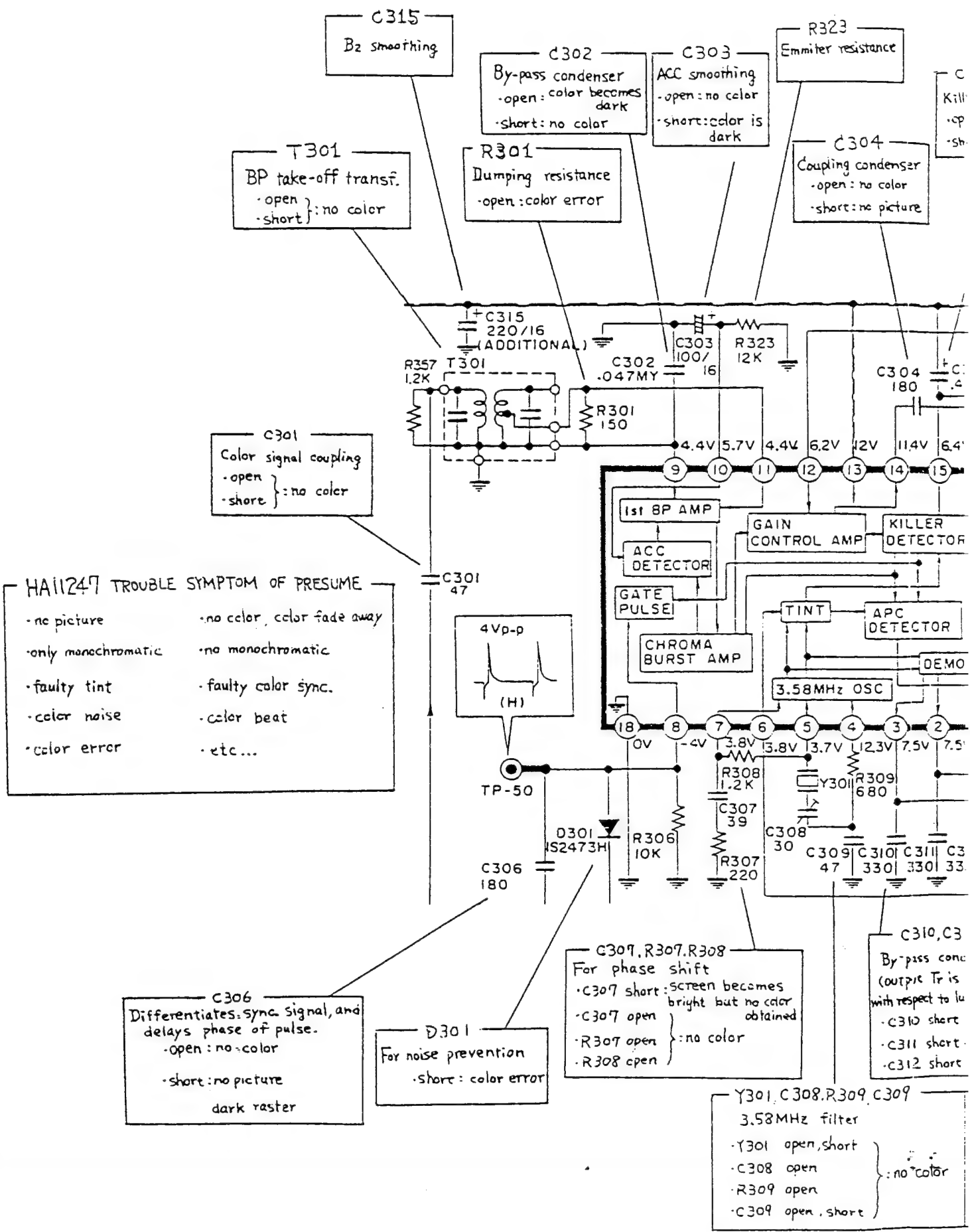
C305 Killer smoothing
-open: no color
-short: no color

R302, R303 Color correction (bleeder resistance)
-R302 open: color is faint
-R303 open: color is dark

R304, R305, R322 tint correction (bleeder resistance)
-R304 open: red raster becomes magenta
-R305 open: red raster becomes green
-R322 open: tint VR does not function

X301, R315, R316, R317
R318, R321, C316
Super-scene control
-R315 open: contrast becomes weak
-R316 open: contrast becomes weak
-R317 open: contrast becomes weak
-R318 open: contrast becomes weak
-C316 short: contrast becomes weak
-X301 open: contrast becomes weak

C315 B2 smoothing



X301, R315, R316, R317
R318, R321, C316

- R315 open
- R316 open
- R317 open
- R321 open
- C316 short
- X301 open

} contrast
: becomes weak

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

- R310, R311, R312 —————
- IC protection resistor
- R310 open: yellow picture
- R311 open: cyanic picture
- R312 open: magenta picture

D303 ~ D308

Protection of IC from CRT sparking

- D303 short : blue picture
- D304 short : red picture
- D305 short : green picture

High frequency filter

- L351 open: yellow picture
- L352 open: cyanic picture
- L353 open: magenta picture

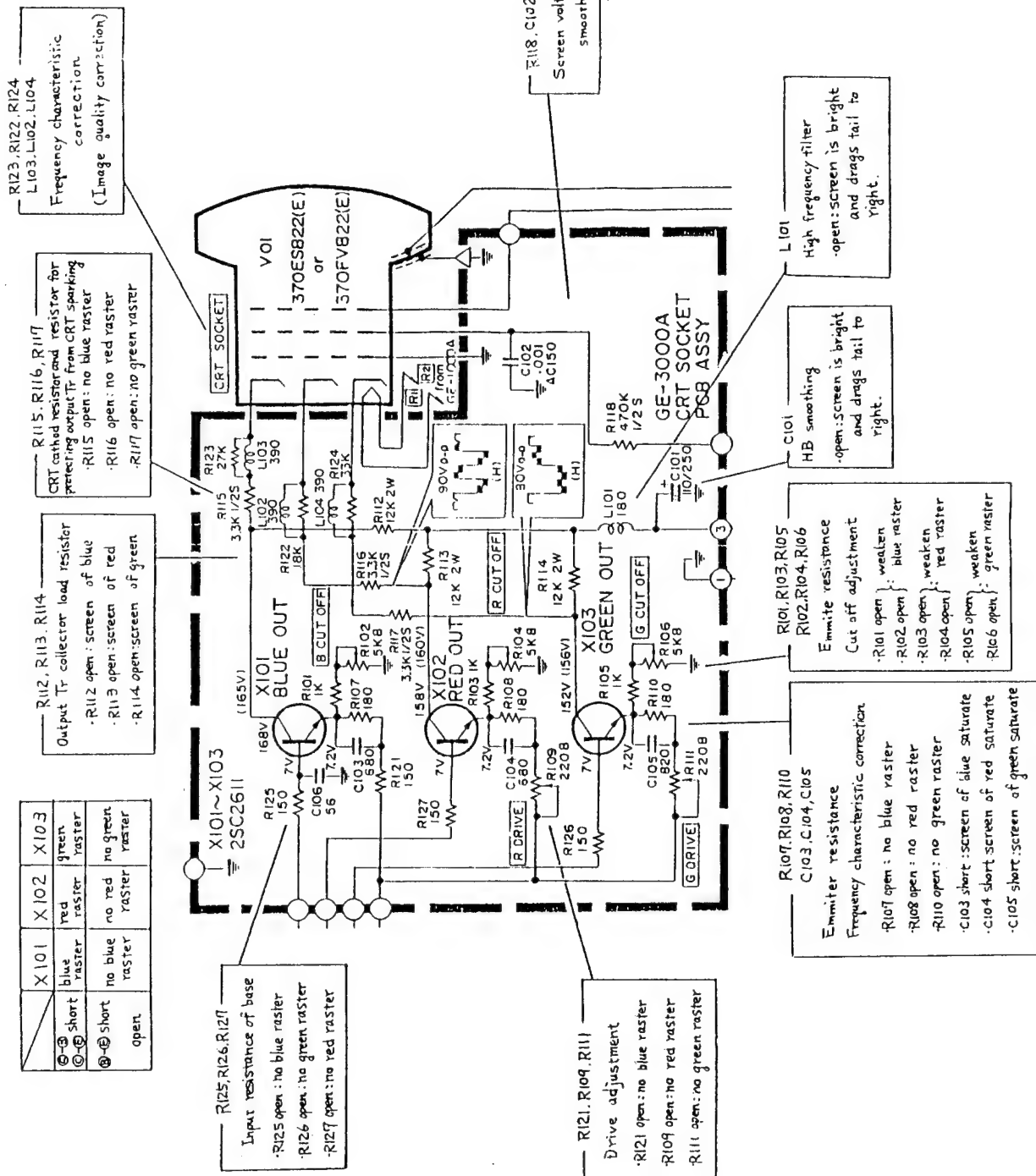
C313, C314, R313, R314
APC smoothing

- C313 short
- C314 short
- R314 open

} : no color



CHROMA OUTPUT CIRCUIT



CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

	X101	X102	X103
⊕-⊕ short	blue raster	red raster	green raster
⊕-⊕ short	no blue raster	no red raster	no green raster
open			

— R112, R113, R114 —
Output Tr collector load-res

- R112 open: screen of blue
- R113 open: screen of red
- R114 open: screen of green

— R125, R126, R127 —
Input resistance of base

- R125 open: no blue raster
- R126 open: no green raster
- R127 open: no red raster

— R121, R109, R111 —
Drive adjustment

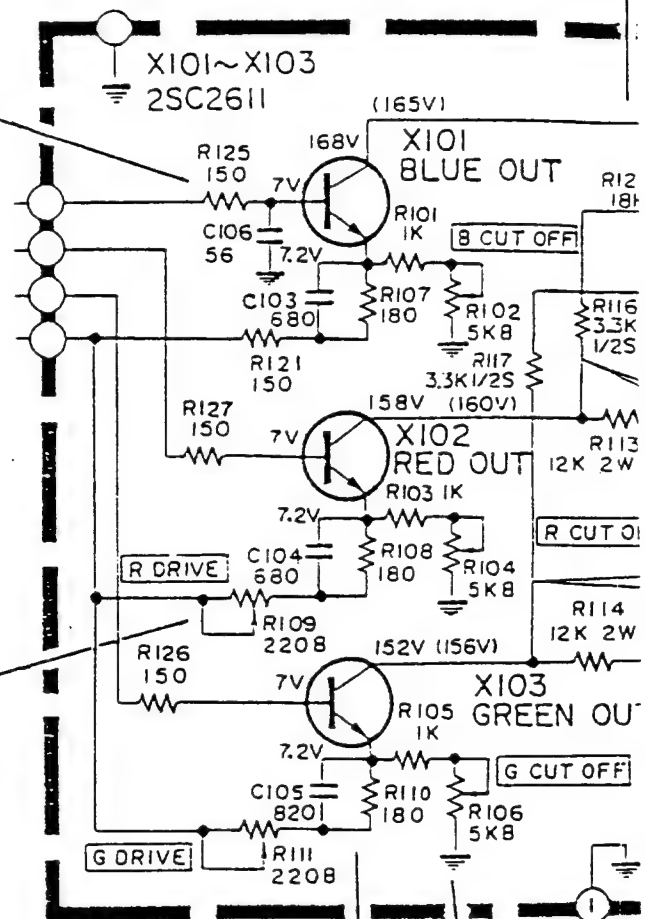
- R121 open: no blue raster
- R109 open: no red raster
- R111 open: no green raster

R107, R108, R110
C103, C104, C105
Emmitter resistance
Frequency characteristic correction

- R107 open: no blue raster
- R108 open: no red raster
- R110 open: no green raster
- C103 short: screen of blue saturate
- C104 short: screen of red saturate
- C105 short: screen of green saturate

R101, R103, R102, R104, R
Emmitter resistance
Cut off adjustment

- R101 open: weak blue
- R102 open: weak blue
- R103 open: weak red
- R104 open: weak red
- R105 open: weak green
- R106 open: weak green



X101	X102	X103
blue raster	red raster	green raster
no blue raster	no red raster	no green raster

R112, R113, R114
Output Tr collector load resistor

- R112 open: screen of blue
- R113 open: screen of red
- R114 open: screen of green

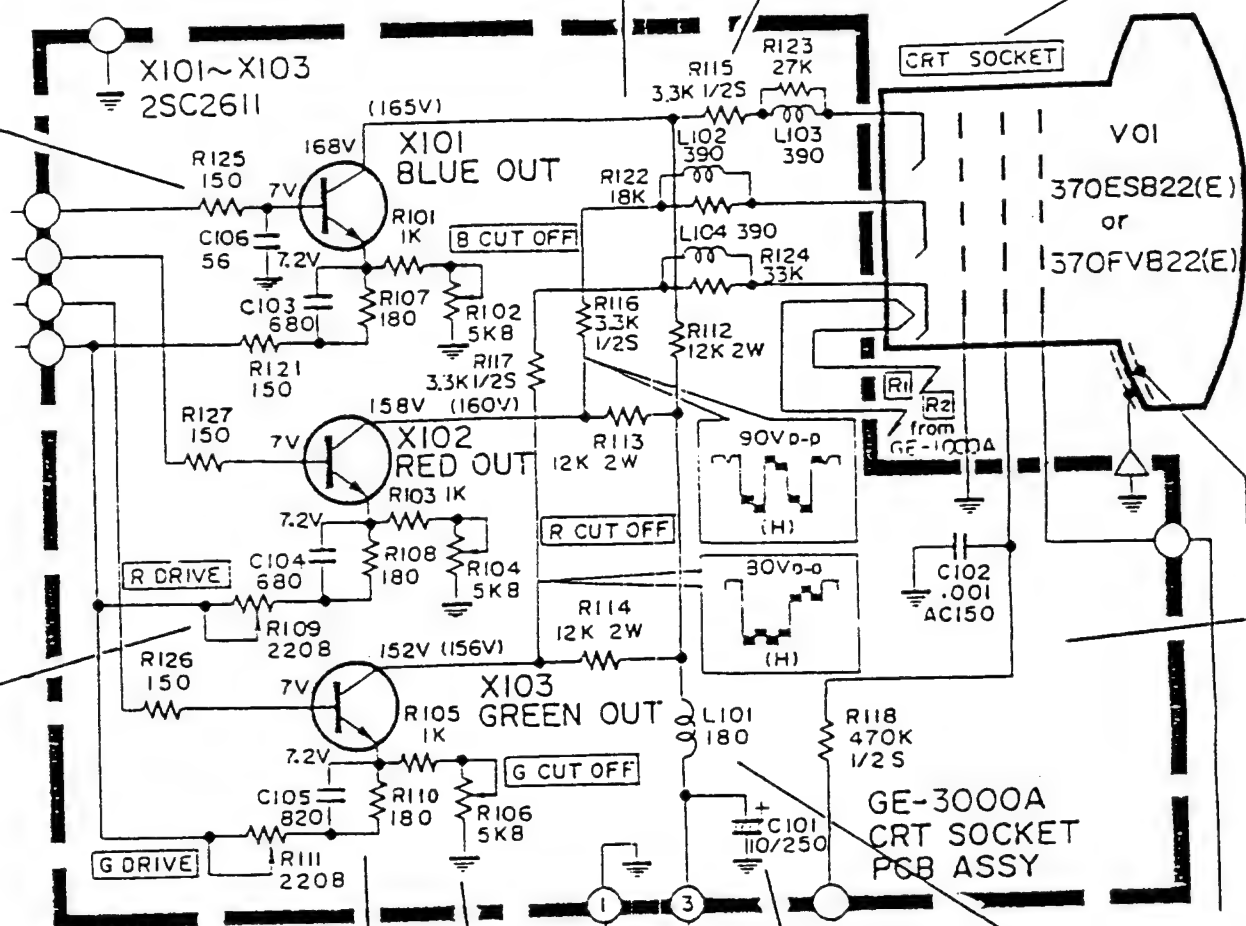
R115, R116, R117
CRT cathod resistor and resistor for protecting output Tr from CRT sparking

- R115 open: no blue raster
- R116 open: no red raster
- R117 open: no green raster

R123, R122, R124
L103, L102, L104
Frequency character correctio
(Image quality cor

base
raster
raster

base
raster
raster



R107, R108, R110
C103, C104, C105

Emmitter resistance
Frequency characteristic correction

- R107 open: no blue raster
- R108 open: no red raster
- R110 open: no green raster
- C103 short: screen of blue saturate
- C104 short: screen of red saturate
- C105 short: screen of green saturate

R101, R103, R105
R102, R104, R106

Emmite resistance
Cut off adjustment

- R101 open: weaken blue raster
- R102 open: weaken red raster
- R103 open: weaken green raster
- R104 open: weaken blue raster
- R105 open: weaken red raster
- R106 open: weaken green raster

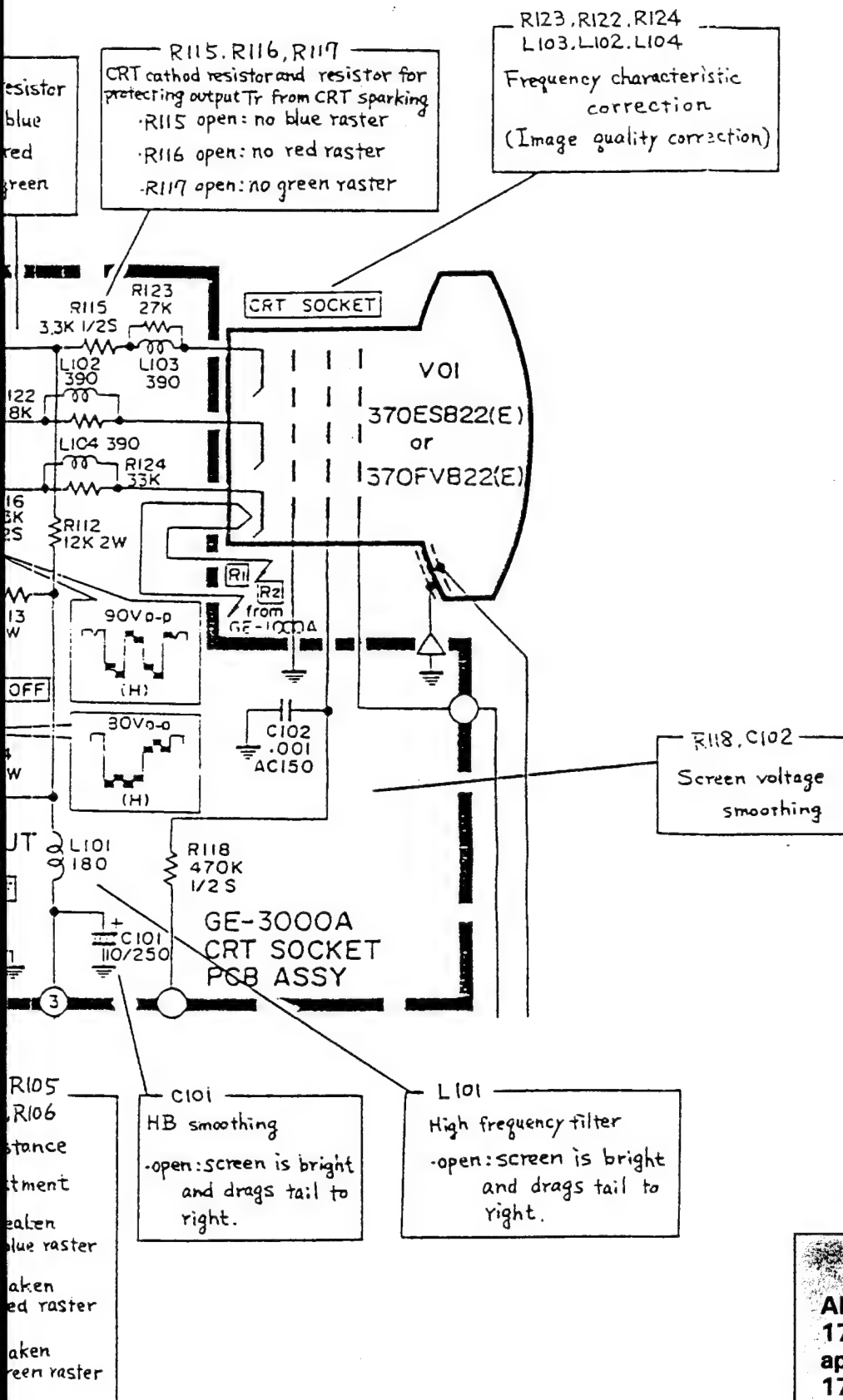
C101
HB smoothing

- open: screen is bright and drags tail to right.

L101
High frequency filter

- open: screen is bright and drags tail to right.

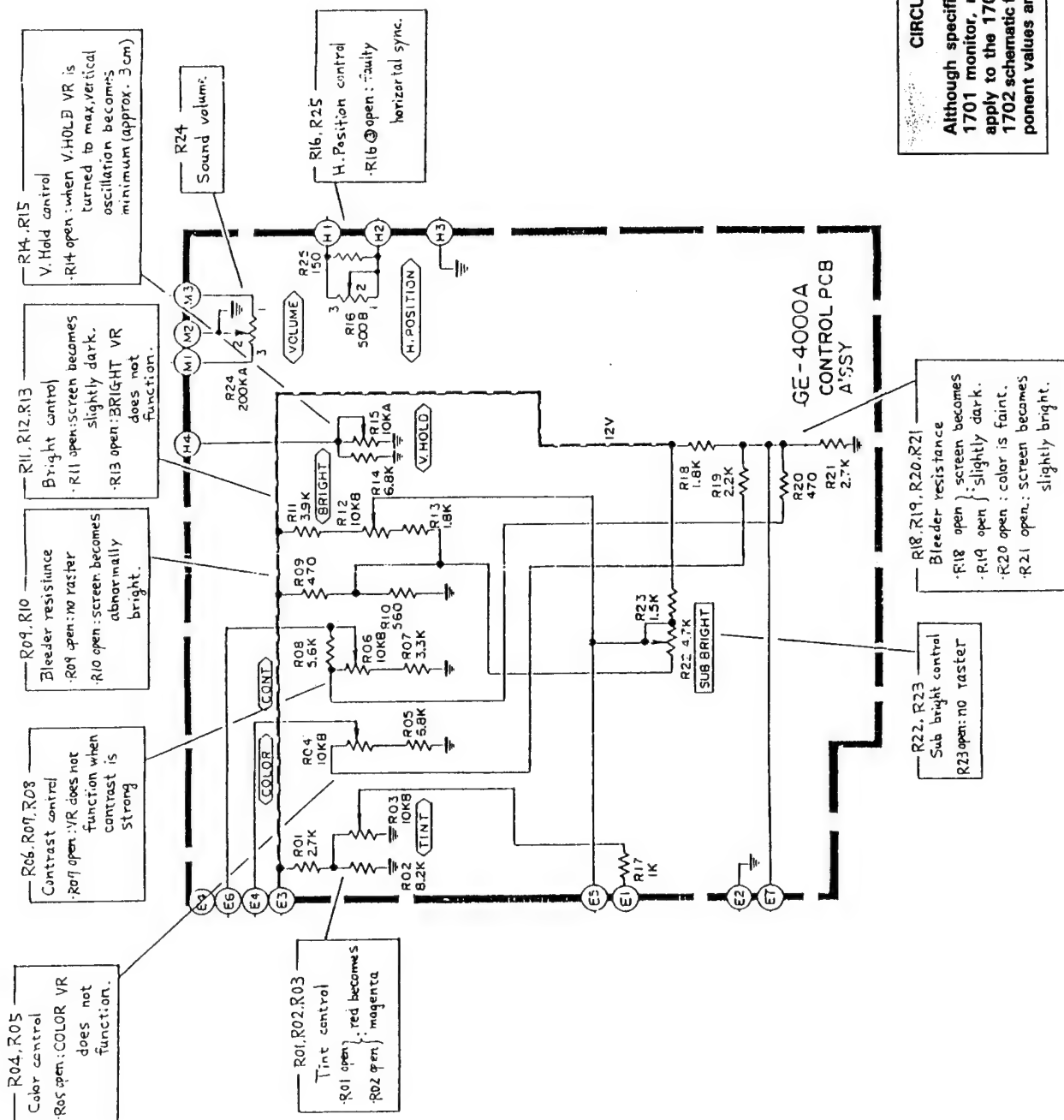
CHROMA OUTPUT CIRCUIT



CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

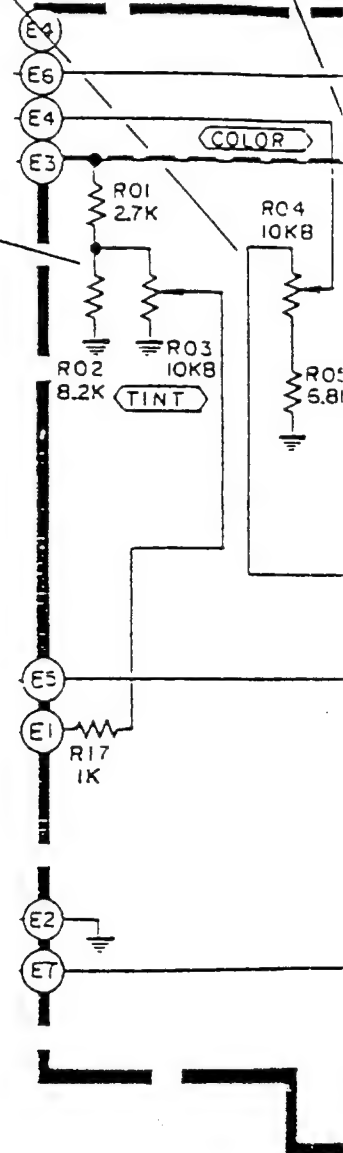
CONTROL



R04, R05
Color control
R05 open: COLOR VR
does not
function.

R06, R07, R08
Contrast control
R07 open: VR does not
function when
contrast is
strong

R01, R02, R03
Tint control
R01 open } red becomes
R02 open } magenta



R22, R23
Sub br
R23 open: r

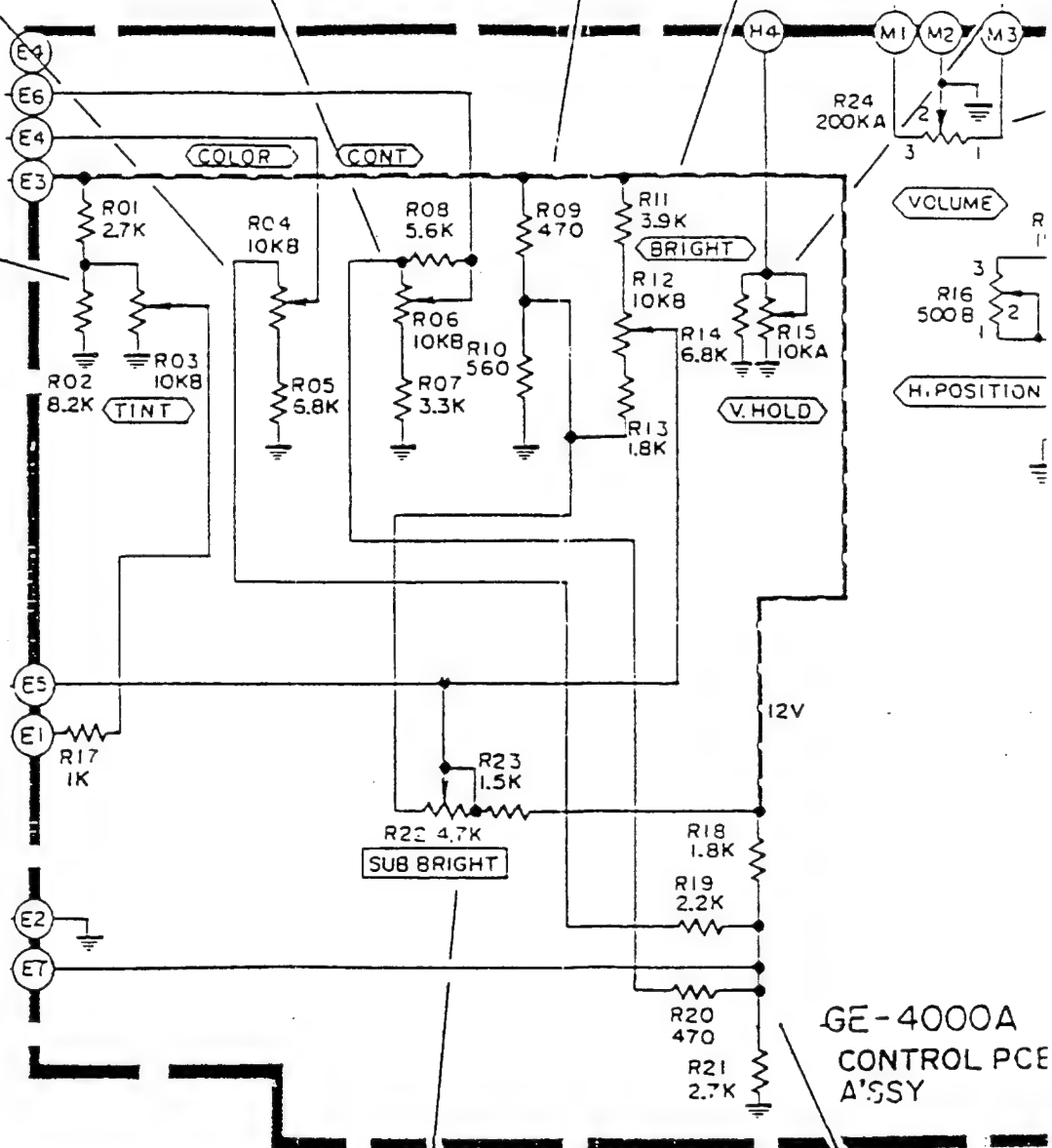
R04, R05
Color control
R05 open: COLOR VR
does not function.

R06, R07, R08
Contrast control
R07 open: VR does not
function when
contrast is strong

R09, R10
Bleeder resistance
R09 open: no raster
R10 open: screen becomes
abnormally
bright.

R11, R12, R13
Bright control
R11 open: screen becomes
slightly dark.
R13 open: BRIGHT VR
does not function.

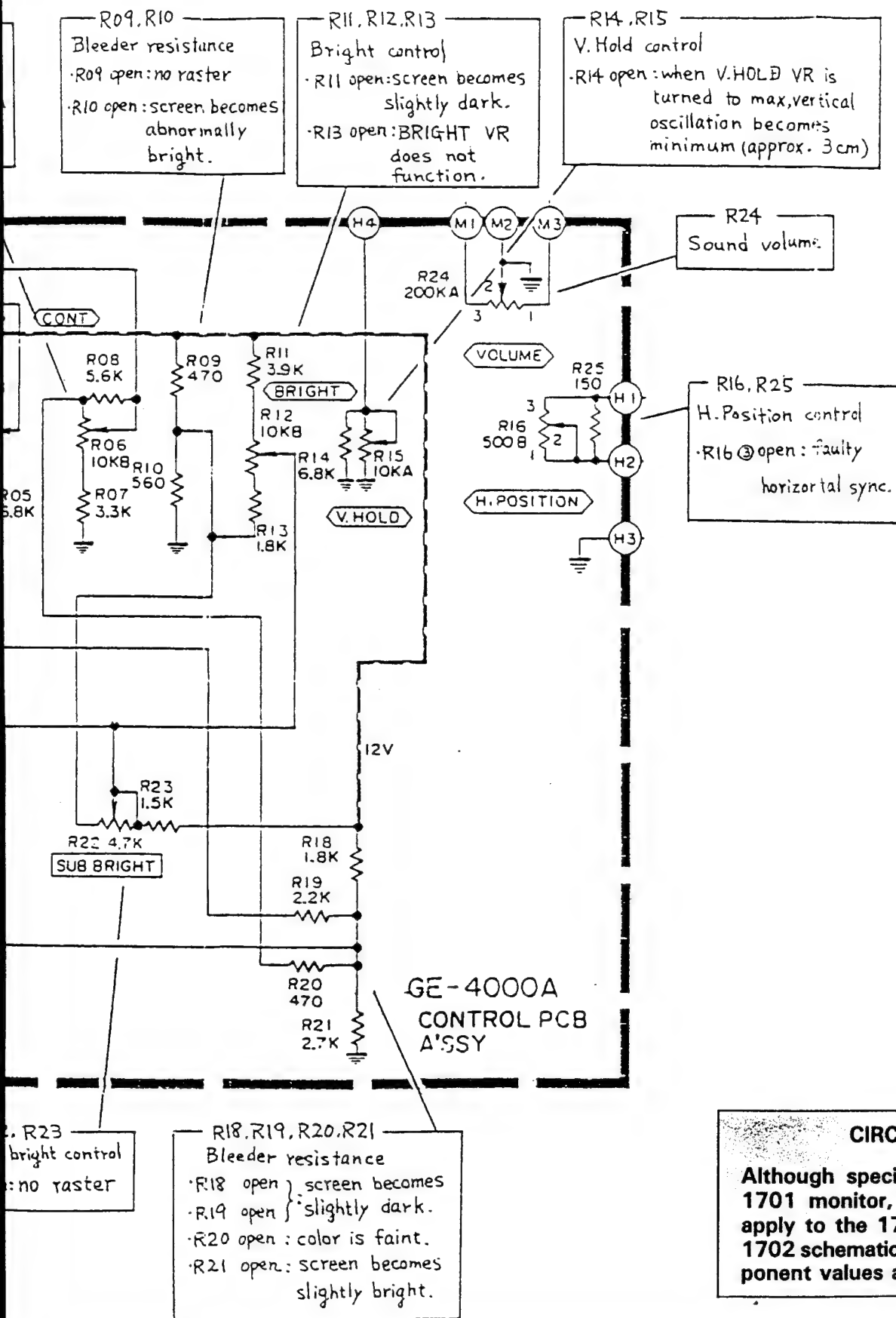
R01, R02, R03
Tint control
R01 open } red becomes
R02 open } magenta



R22, R23
Sub bright control
R23 open: no raster

R18, R19, R20, R21
Bleeder resistance
R18 open } screen becomes
R19 open } slightly dark.
R20 open: color is faint.
R21 open: screen becomes
slightly bright.

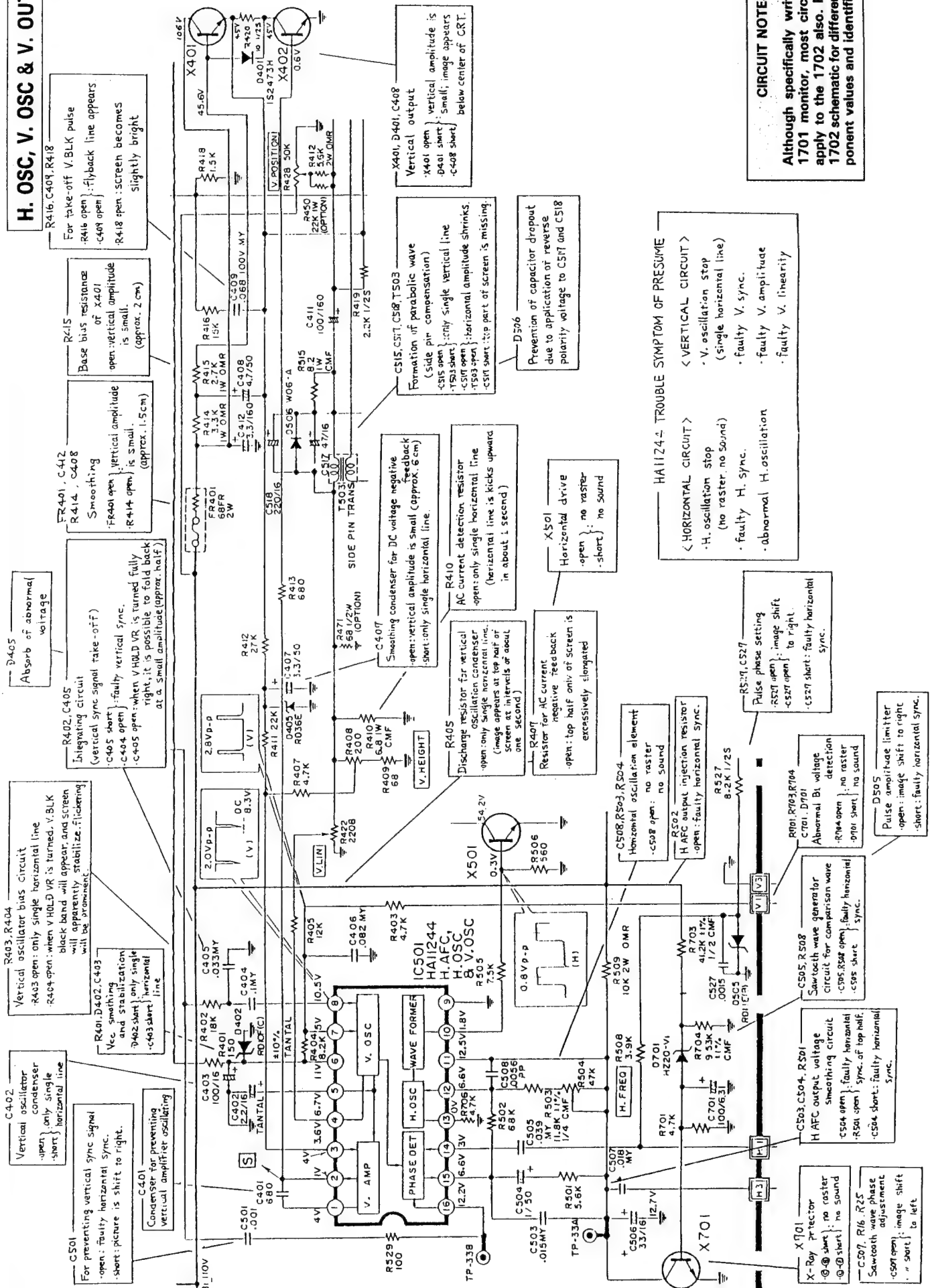
CONTROL



CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

H. OSC, V. OSC & V. OUT CIRCUIT



CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

R403, R404
Vertical oscillator bias circuit
R403 open: only single horizontal line
R404 open: when V HOLD VR is turned, V.BLK black band will appear, and screen will apparently stabilize. flickering will be prominent.

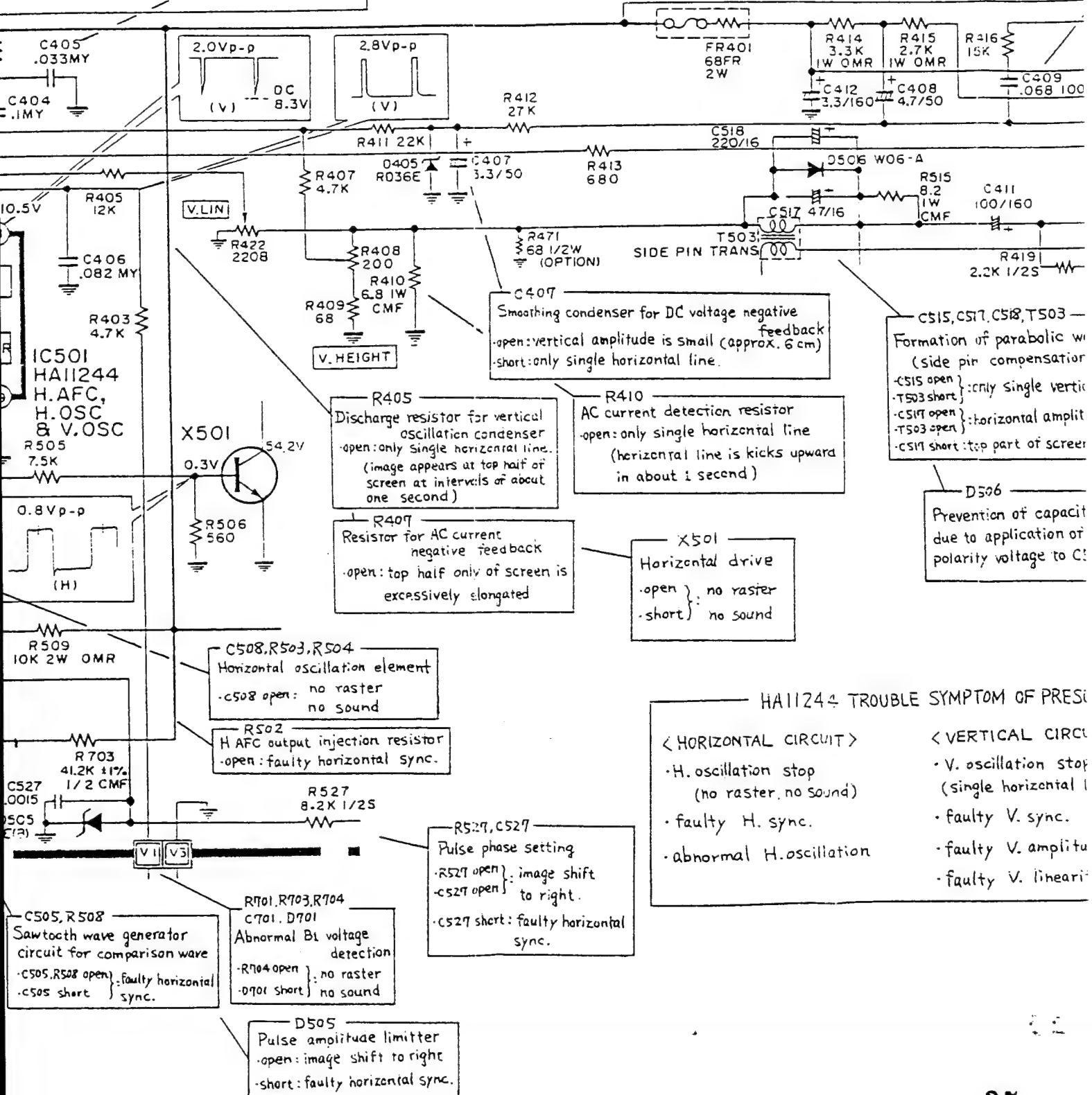
C403
Vertical sync signal take-off
only single horizontal line

D405
Absorb of abnormal voltage

R402, C405
Integrating circuit
(vertical sync signal take-off)
-C405 short } : faulty vertical sync.
-C404 open }
-C405 open: when V HOLD VR is turned fully right, it is possible to fold back at a small amplitude (approx. half)

FR401, C412
R414, C408
Smoothing
-FR401 open } vertical amplitude is small.
-R414 open } (approx. 1.5cm)

R415
Base bias resistance of X401
-open: vertical amplitude is small. (approx. 2 cm)



- R416, C409, R418

-R416 open } : flyback line appears.
-C409 open }

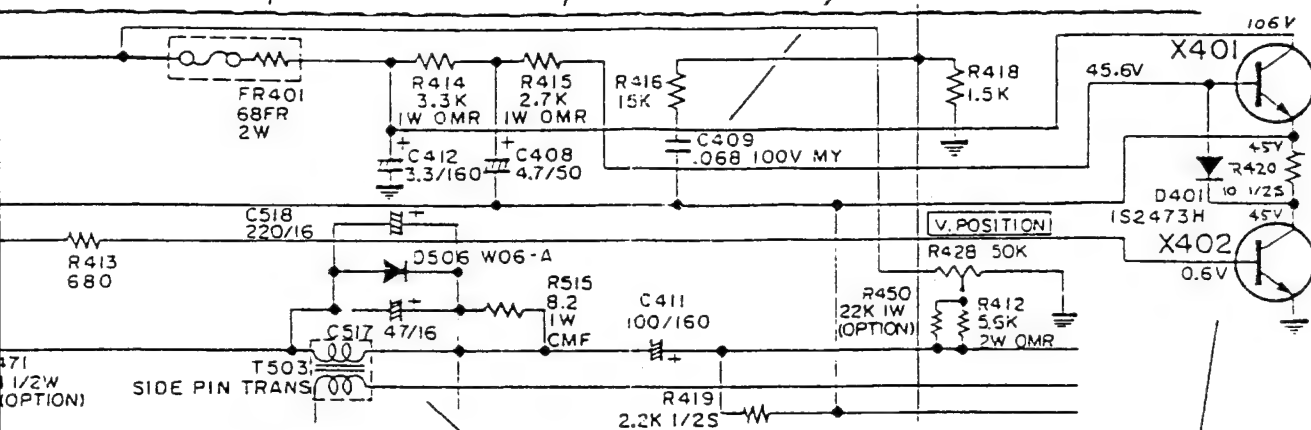
R418 open: screen becomes slightly bright

Smoothing

FR401 open } vertical amplitude
R414 open } is small.
(approx. 1.5cm)

- R4-15

Base bias resistance
of X401
open: vertical amplitude
is small.
(approx. 2 cm)



ing condenser for DC voltage negative
vertical amplitude is small (approx. 6 cm) ^{feedback}
only single horizontal line.

- R410

AC current detection resistor
open: only single horizontal line
(horizontal line is kicks upward
in about 1 second)

- C515, C517, C518, T503

Formation of parabolic wave
(side pin compensation)

- CS15 open } only single vertical line
- T503 short }
- CS14 open } horizontal amplitude shrinks.
- T503 open }
- CS14 short } top part of screen is missing.

- D526

Prevention of capacitor dropout due to application of reverse polarity voltage to C517 and C518

-X401, D401, C408

Vertical output

-X401 open } vertical amplitude is
 -D401 short } small; image appears
 -C408 short } below center of CRT.

< HORIZONTAL CIRCUIT >

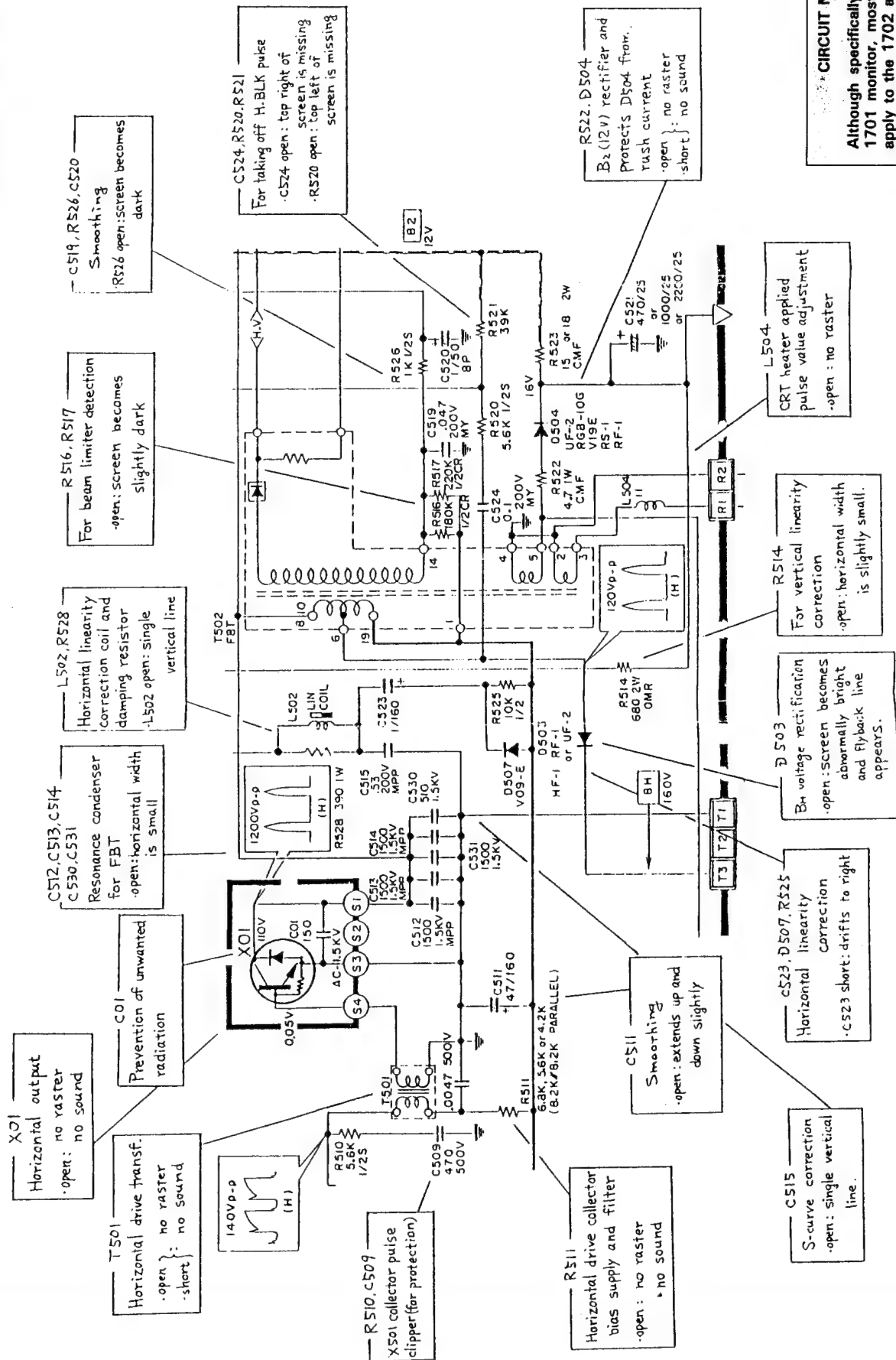
- H. oscillation stop
(no raster, no sound)
- faulty H. sync.
- abnormal H. oscillation

< VERTICAL CIRCUIT >

- V. oscillation stop (single horizontal line)
- faulty V. sync.
- faulty V. amplitude
- faulty V. linearity

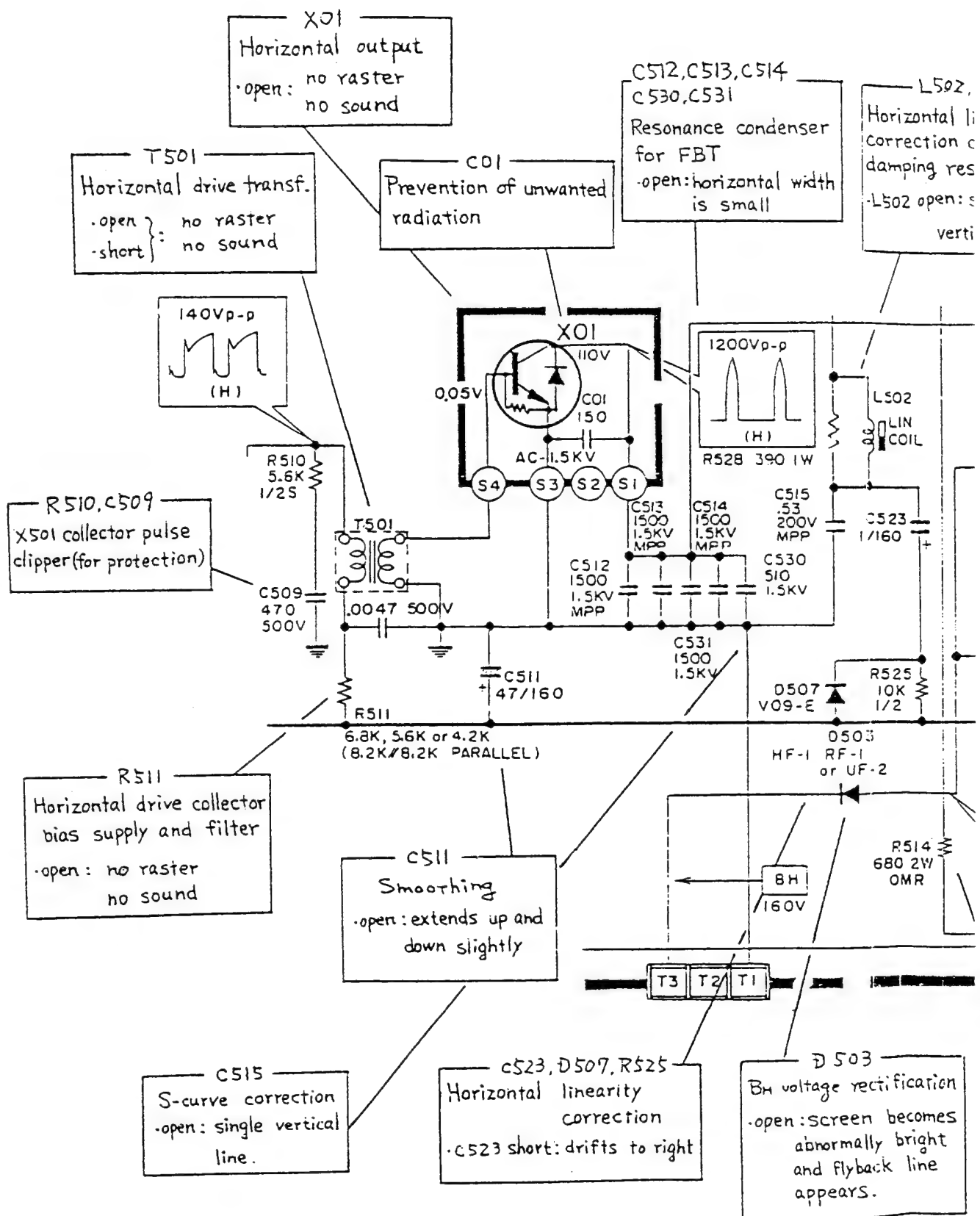
Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

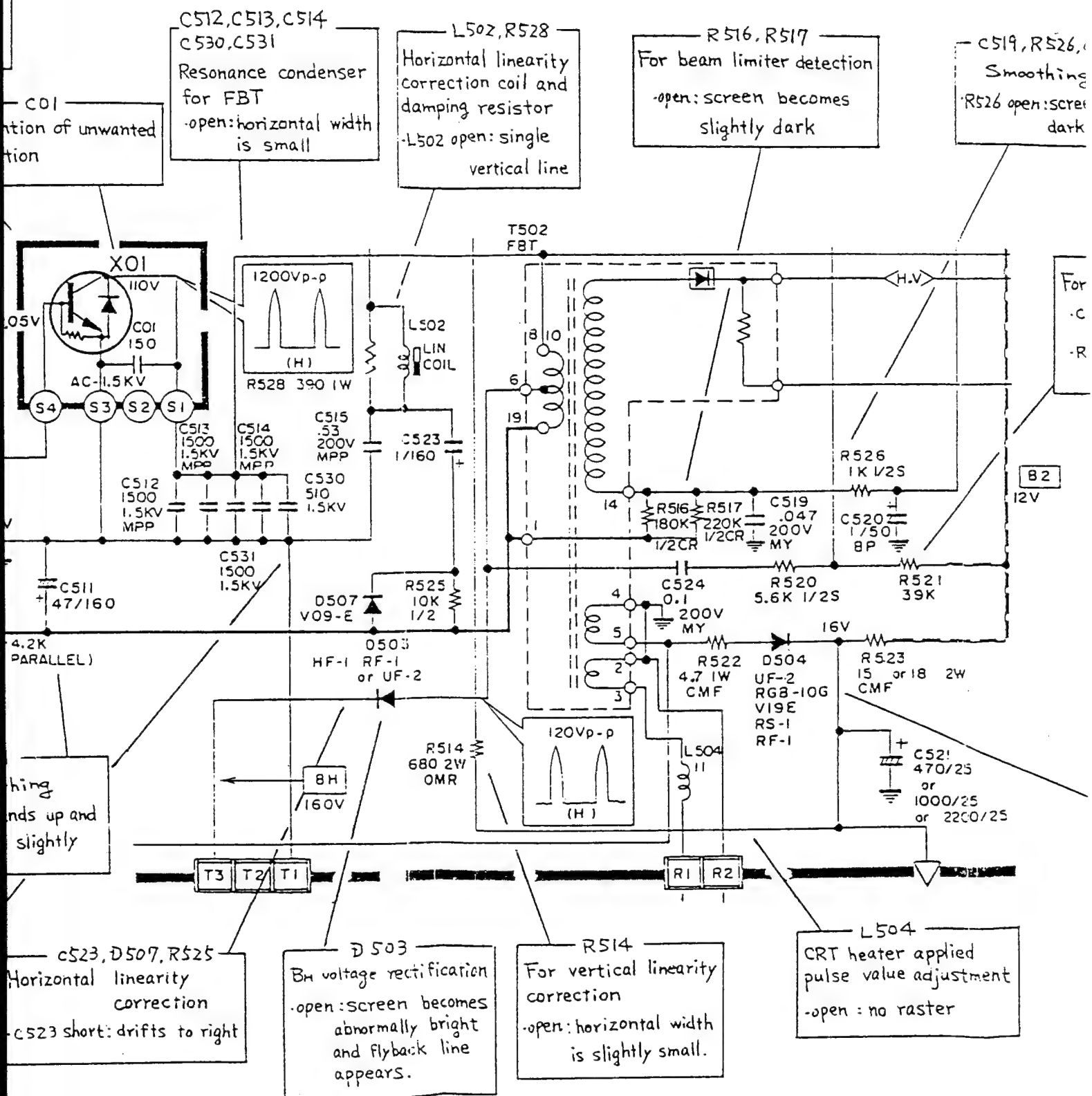
HORIZONTAL OUTPUT CIRCUIT



CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.



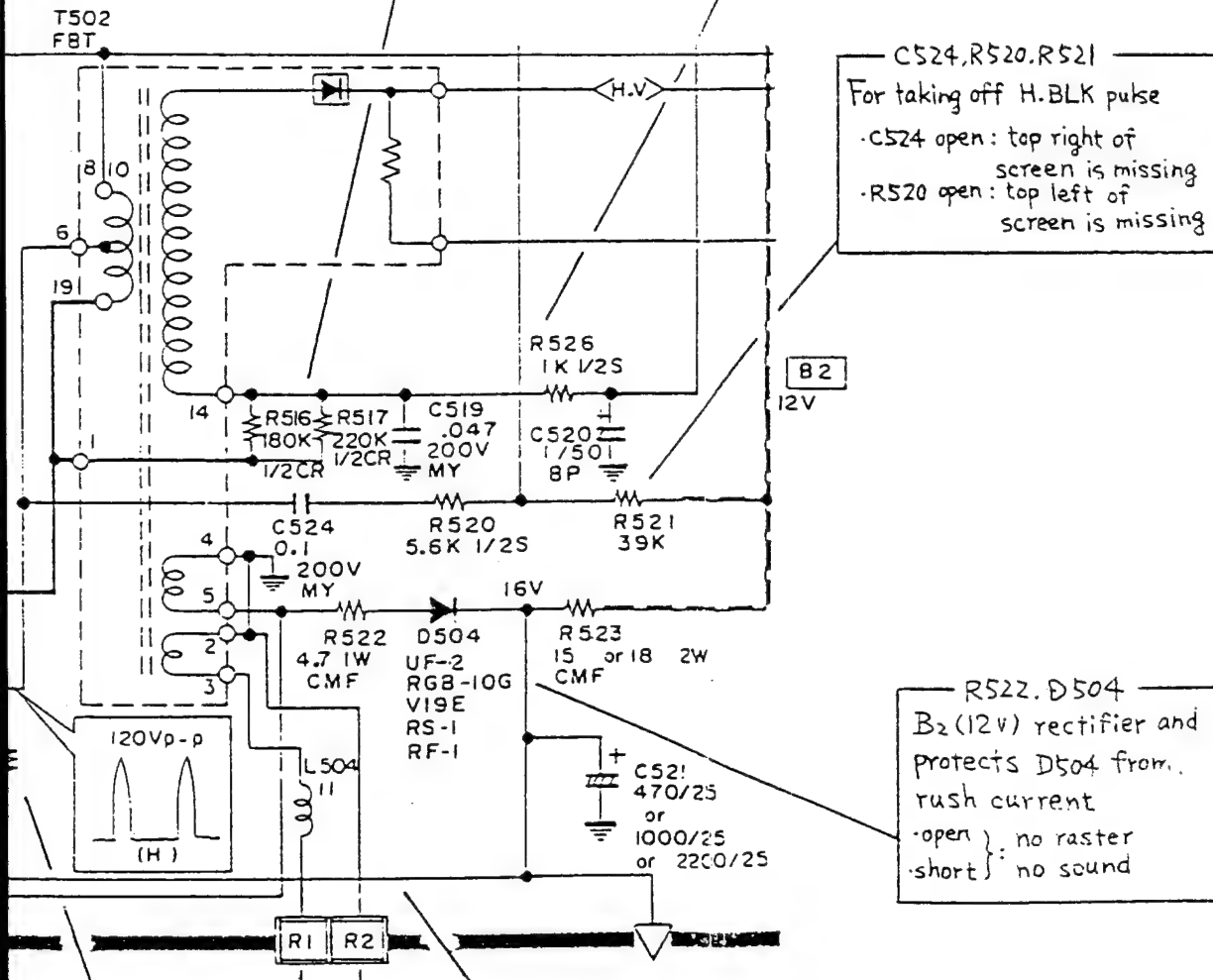


HORIZONTAL OUTPUT CIRCUIT

R502, R528
al linearity
on coil and
resistor
n: single
vertical line

R516, R517
For beam limiter detection
-open: screen becomes
slightly dark

C519, R526, C520
Smoothing
-R526 open: screen becomes
dark



C524, R520, R521
For taking off H.BLK pulse
-C524 open: top right of
screen is missing
-R520 open: top left of
screen is missing

R522, D504
B2 (12V) rectifier and
protects D504 from
rush current
-open } no raster
-short } no sound

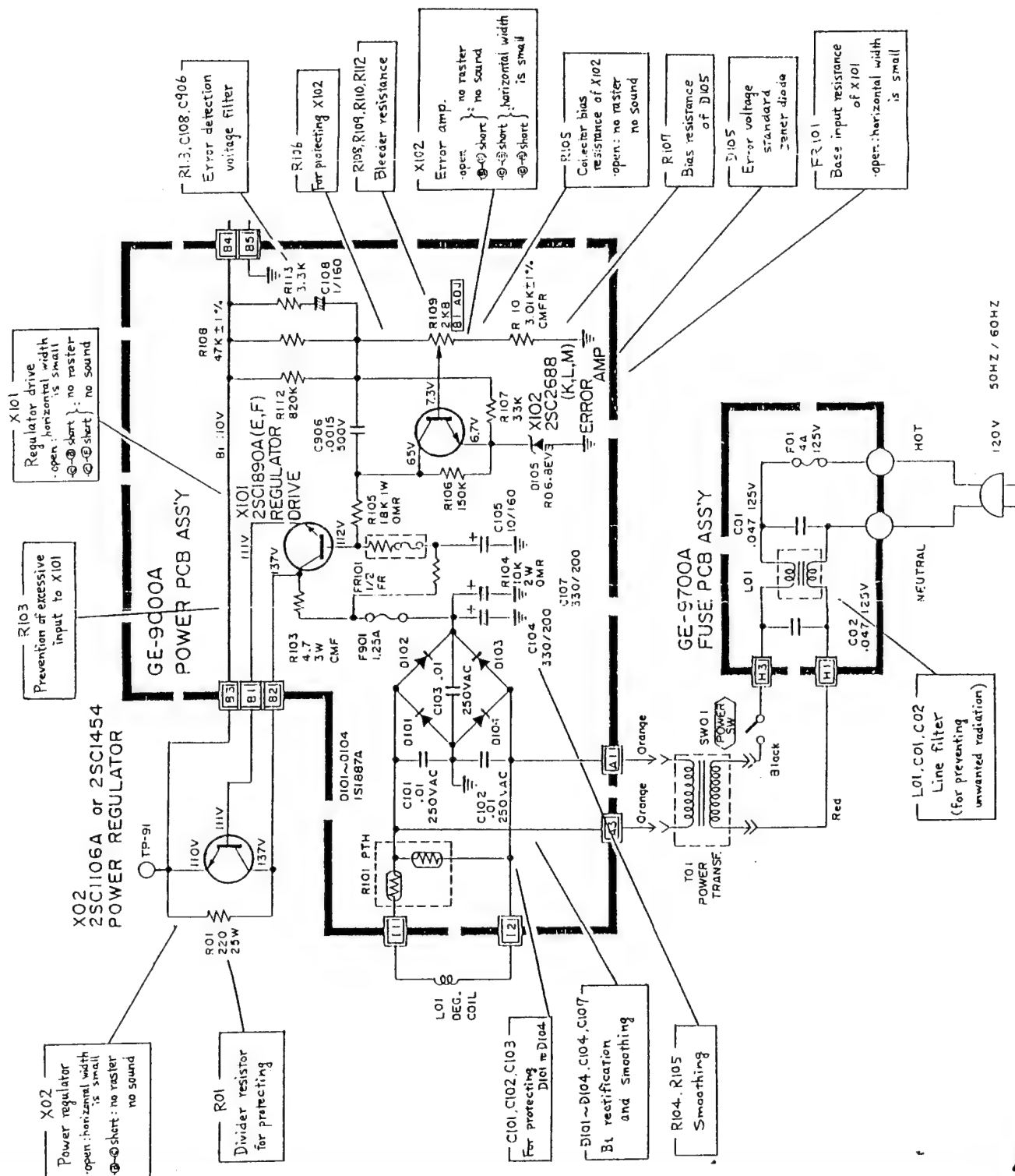
R514
For vertical linearity
correction
-open: horizontal width
is slightly small.

L504
CRT heater applied
pulse value adjustment
-open: no raster

CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

POWER CIRCUIT



CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

X02
Power regulator
-open: horizontal width
is small
-short: no raster
no sound

R01
Divider resistor
for protecting

X02
2SC1106A or 2SC1454
POWER REGULATOR

R103
Prevention of excessive
input to X101

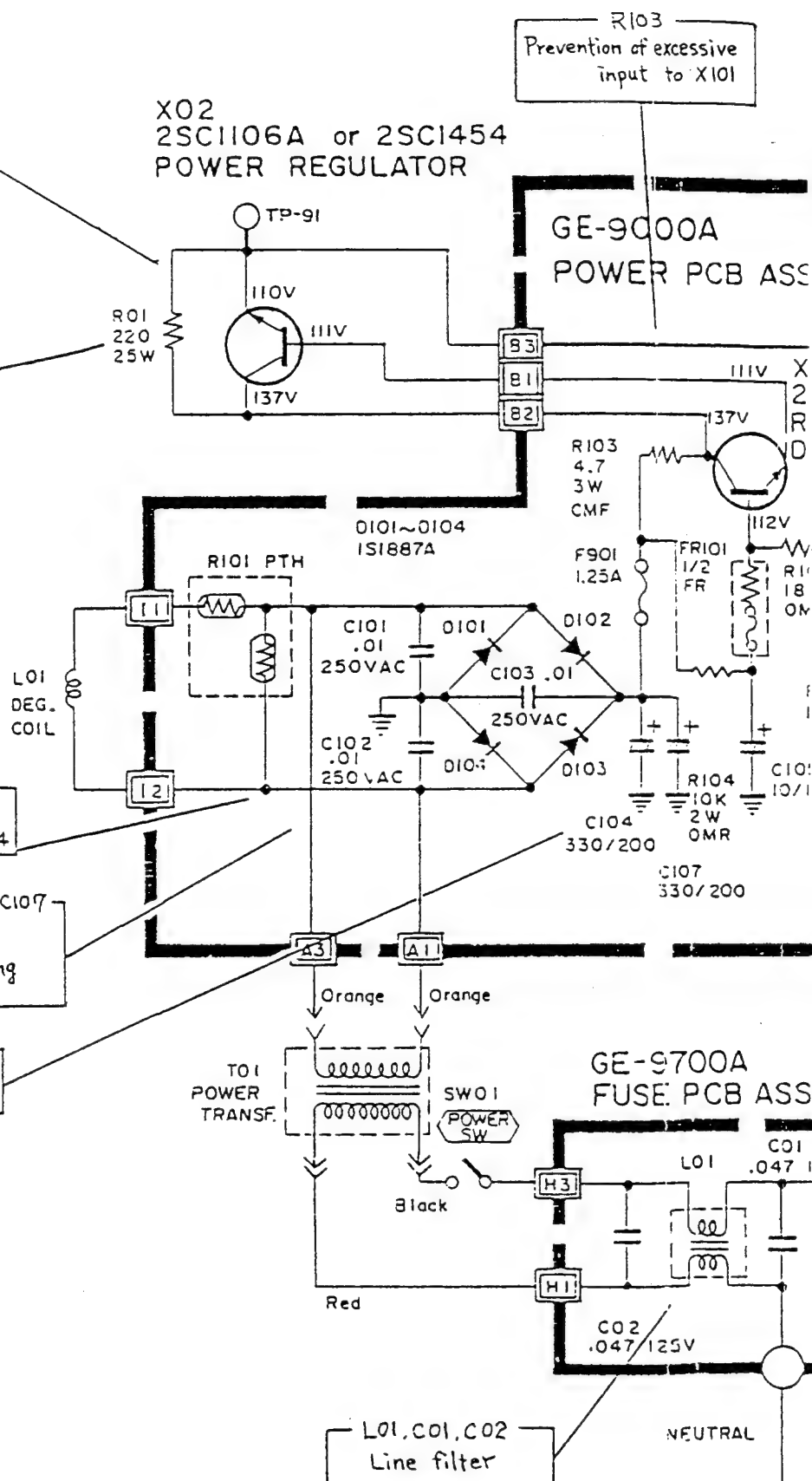
GE-9000A
POWER PCB ASS

C101, C102, C103
For protecting
D101 to D104

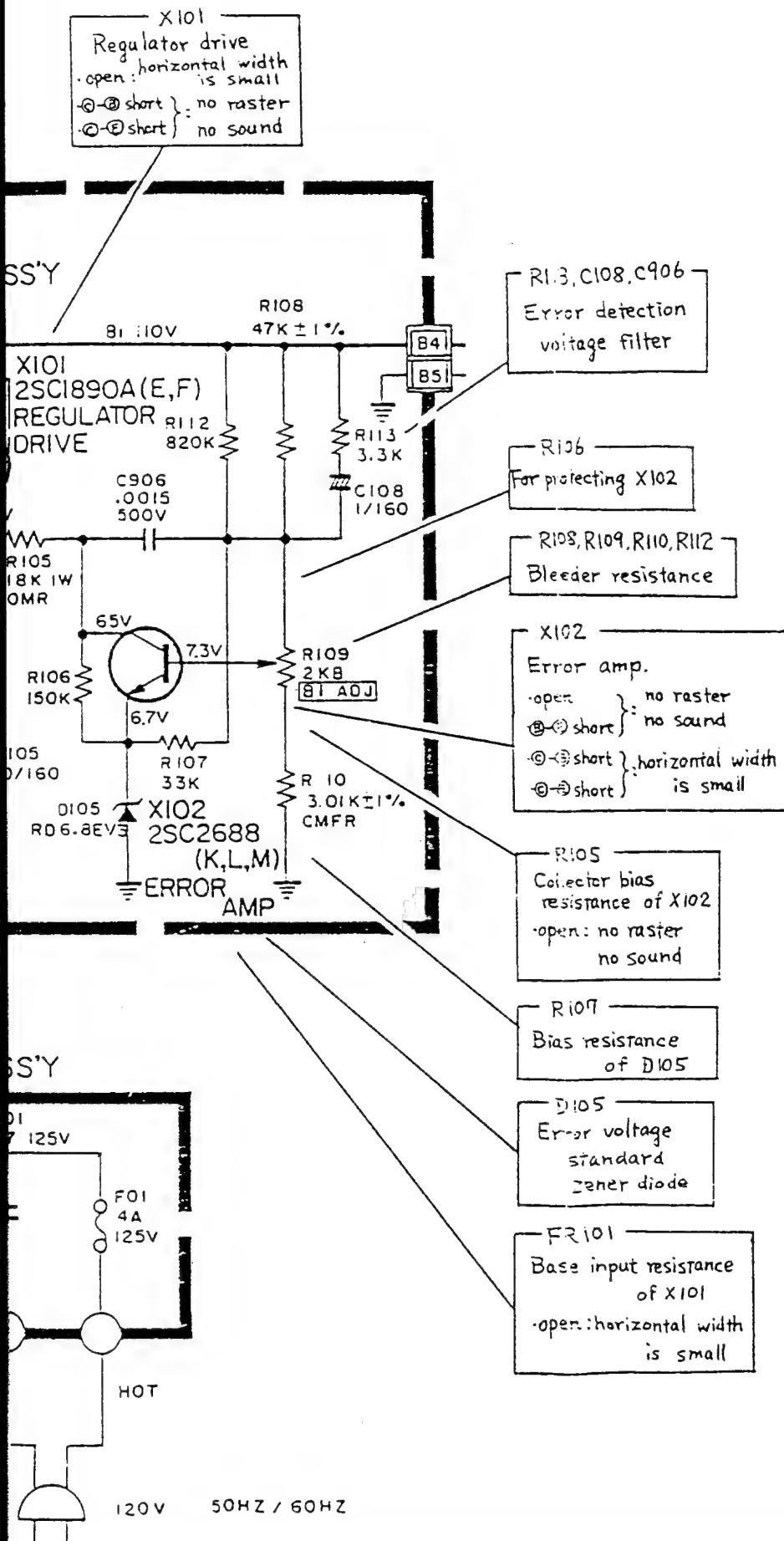
D101 ~ D104, C104, C107
B1 rectification
and smoothing

R104, R105
Smoothing

L01, C01, C02
Line filter
(for preventing
unwanted radiation)



POWER CIRCUIT



CIRCUIT NOTES

Although specifically written on the 1701 monitor, most circuit theories apply to the 1702 also. Refer to the 1702 schematic for differences in component values and identification.

TROUBLESHOOTING GUIDE

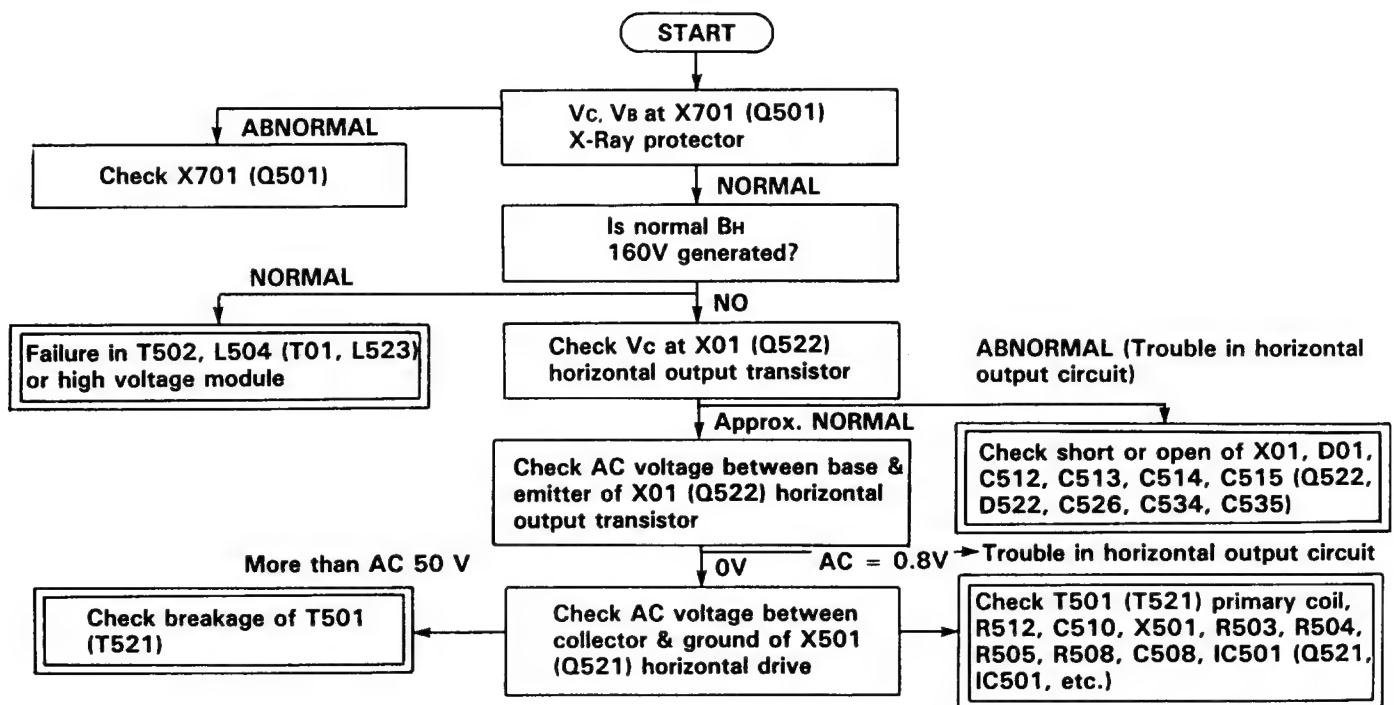
No raster, no sound (B₁ is normal)

NOTE: 1702 locations in ().

[Cause] Horizontal deflection circuit

Problems in the horizontal deflection circuit hinder generation of high focusing voltage, B_H 160V and B₂ 12V, resulting in no raster, no sound.

1. As long as normal B_H 160V is generated, the horizontal output circuit properly operates, producing pulses during the flyback period of the saw-tooth wave current passing through the horizontal deflection coil. If a problem is found with normal B_H voltage, the problem area should be the secondary coil of the flyback transformer.
2. When the AC voltage between base and emitter of the horizontal output transistor X01 (Q522) is about 0.8V, it is supplied with input pulses. The problem is therefore in the horizontal output circuit. When, however, X01 (Q522) is shorted, this AC voltage is not indicated even if there are input pulses at X01 (Q522).
3. AC voltage is measured between the collector and ground of X501 (Q521) horizontal drive as shown. When the specified voltage is shown on the meter, the horizontal output circuit is the problem; while, when there is no voltage indication, the trouble is in some element(s) preceding X501 (Q521). Check if those transistors and ICs are damaged using a voltage measurement.



No raster, no sound (B₁ is abnormal)

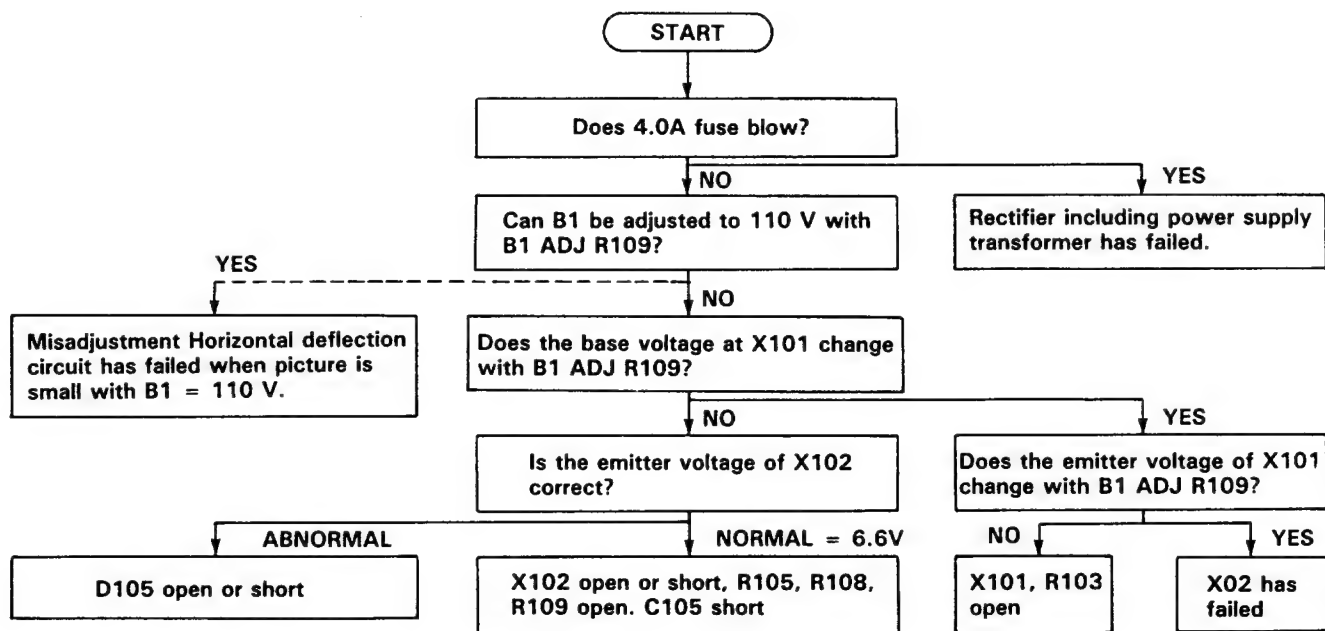
NOTE

1702 locations in (). The regulator PCB assembly used in 1702 models differs from the 1701 power PCB assembly. The B₁ voltage circuits should be checked beginning with IC901.

[Cause]

Abnormal B₁ voltage indicates trouble in the power supply circuit. When B₁ voltage is not only low but also abnormally high, X701 (Q501) of the X-ray protector is turned on, setting the collector voltage to 0 V. The horizontal oscillator is then disabled resulting in no raster and no sound.

1. When D105, R105, R108, R109 are open, the base voltage of X101 and X102 rise to increase B₁ voltage to more than 130V. This causes the X-ray protector to work, resulting in no raster.
2. If the base voltage drops as when R103 is open or C105 is shorted, the B₁ voltage is reduced to less than 40 V. This will mostly result in no raster, no sound.
3. When the B₁ voltage drops to about 70 V, because R910 is open and D105 is shorted, the screen becomes dark and the raster size is reduced because of insufficient horizontal and vertical amplitude.



No picture (no raster) with normal sound

NOTE: 1702 locations are in ().

[Cause] Malfunction of the video amplifier IC201, X202 (IC201, Q201)

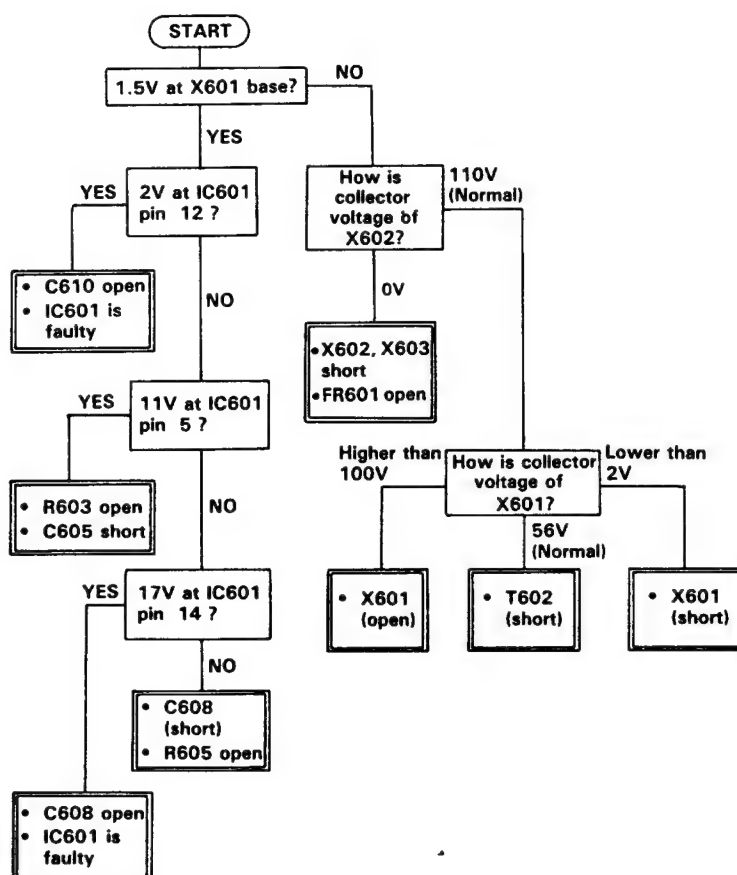
The video signal and the audio signal output are supplied respectively to the video amplifier IC201 and the audio circuit IC601. Sound is had but no picture; therefore, the faulty part is IC201 and its external elements. Since pin 16 of the IC201 to the cathode of CRT is connected by a DC-coupled amplifier, a fault raising the emitter voltage of X202 (Q201) will cause the three initial output transistors to cut off, resulting in no raster.

Check also the screen grid circuit for igniting the CRT heater and the high voltage module.

No sound (with normal picture)

NOTE: 1701 — Flowchart
1702 — Audio circuit has been reduced to IC601.

[Cause] Trouble in the audio circuit IC601, X601, X603 or X604 are faulty.



Only single horizontal line, normal sound

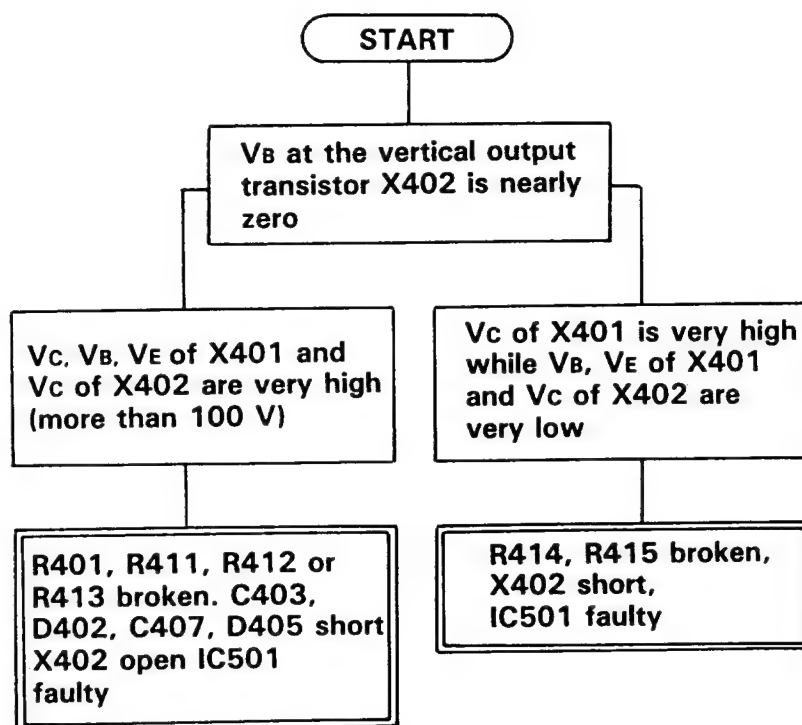
NOTE: 1701 — First check if FR401 is broken or not. If this is broken, the trouble is due to short of X401 or break of D401.

1702 — Circuits in 1702 monitor differ but the operation remains the same. Check vertical controls/deflection circuits.

[Cause] Malfunction of the vertical deflection circuit. When the vertical deflection circuit is faulty, saw-tooth current is not applied to the vertical deflection coil, resulting in a single horizontal line. During troubleshooting, reduce brightness contrast to prevent an ion spot on the CRT.

1. R401 broken, C403, D402, C413 short: B2 12V is not supplied, disabling IC501.
2. R411, R412 broken, C407 short: the voltage at IC501 pin 3 is set to zero disabling the V-amplifier and the voltage at pin 2 is set to zero to turn off X402.
3. R414, R415 are broken: V_B of X401 is zero disabling X401 and X402.
4. Also check if C402 is short or open.
5. Too high V_B of X402 is because of C401 short or failure in IC501 or X402.

Note: When the voltage generator fails to supply B2 12V to the secondary coil of the flyback transformer of the horizontal output circuit due to malfunction, a single horizontal line and no sound will result.



[Faulty parts and problems other than described]

X401 open D401 short C408 short	Vertical amplitude small (6 - 8 cm) Picture appears only on the lower half of the screen
R403 faulty	A single thick (ca. 5 mm) horizontal line
R404 faulty	When turning V. HOLD, a black belt (V blanking signal) appears at the center of screen. The whole screen is dark and flickers.
R405 faulty	A single horizontal line. A picture flashing at about 1 second interval appears on the upper half of the screen.
R407 faulty	A picture of about 4 cm at the center of the screen. About 25 irregular lines appear on the upper half of the screen.
R408 and R409 faulty	Vertical amplitude small (about 15 cm)
R410 faulty	Vertical amplitude small (about 2 cm). Picture goes slightly up and down and flickers.
R416 faulty C409 open	Vertical flyback line appears.
R419 faulty	Small number of irregular lines

Improper horizontal or vertical synchronization

NOTE: 1701 and 1702 locations are the same.

[Cause]

1) Defective horizontal and vertical sync:

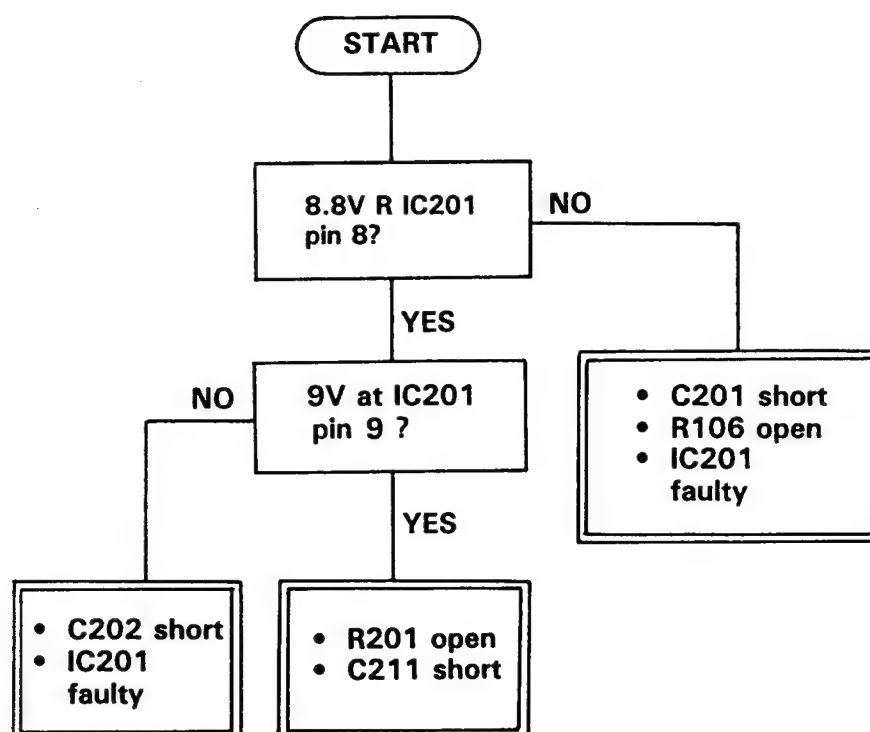
The sync separator and amplifier consists of an IC(IC201). The main cause of failure is often a failure of the IC itself. It is also necessary to be careful of a possible failure of the external components. Because the change of voltage at each pin of the IC is extremely small, it is very difficult to discover a failed element by measuring voltage.

2) Defective horizontal sync:

This is due to a failure of IC501 or the horizontal AFC circuit.

3) Defective vertical sync:

This is due to a failure of either the separator and amplifier for the vertical synchronous signal, or the vertical oscillator IC501 and its peripheral elements.



Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C 314-xxx-xx) will be available from Commodore at this time.

1701 CHASSIS PARTS

LOCATION	DESCRIPTION	JVC PART #	COM PART #
DY01	Deflection Yoke	* CJZ6134-00A	* C 314916-01
J01	Pin Jack Vid In	C39Z27-224	
J02	Pin Jack Aud In	C39Z27-223	
L21	Deg. Coil	* A39477-T	
R05	Nonflammable Res. 220 ohm, 25W, $\pm 10\%$	* QRF258K-221	* C 314917-01
S01	Power Switch	* CEX40097-002	* C 314918-01
SP01	Speaker	EAS-10P225S	
T01	Power Transformer	* CE30074-B0A	* C 314919-01
T502	HV Module	* CJ26107-00A	* C 314920-01
V01	Picture Tube	* 370FVB22(E) Sub: * 370ESB22(E)	
X01	Transistor	* 2SD869 Sub: * 2SD898	* C 314921-01
X02	Regulator	* 2SC1106A	* C 314922-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

1701 CABINET PARTS

LOCATION	DESCRIPTION	JVC PART #	COM PART #
1701/1702	Front Cabinet		C 314900-01
1701/1702	Front Cntrl Panel Door		C 314901-01
1701/1702	Power Button		C 314902-01
1701	Front Model I.D. Plate		C 314903-01
1701/1702	RT Side Handle		C 314904-01
1701/1702	LT Side Handle		C 314905-01
1701/1702	Rear Cabinet		C 314906-01
1701/1702	Rear A/V Terminal Assy		C 314907-01
1701/1702	Top Cabinet Panel		C 314908-01
1701/1702	Replacement AC Cord	* QMP1460-244K	* C 314909-01
1701	Users Manual		C 314910-01
1701/1702	Namplate (Logo)		C 314911-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

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MAIN PCB ASSEMBLY # GE-1000A

LOCATION	DESCRIPTION	JVC PART #	COM PART #
INTEGRATED CIRCUITS			
IC1201 IC1301 IC1501 IC1601		HA11401 HA11247 HA11244 HA11107	
TRANSISTORS			
X1101 X1202 X1250 X1301 X1351 X1352 X1401 X1402 X1501 X1601 X1602 X1603 X1701		2SC1959 (Y) 2SA1015 (Y) 2SC1815 (Y, GR) 2SC1815 (Y, GR) 2SC1815 (Y, GR) 2SC1815 (Y, GR) 2SD401A (K, L) 2SD401A (K, L) 2SC2371V 2SD668A (B, C) 2SD668A (C) 2SB648A (C) 2SC1815 (Y, GR)	
DIODES			
D1201 D1202 D1203 D1301 D1302 D1401 D1402 D1405 D1503 D1504 D1505 D1506 D1507 D1508 D1601 D1701	Zener Zener Zener Zener	IS2471V-Y W06B W06B 1S2473H-Y 1S2473H-Y 1S2471V-Y RD11E (B)-Y RD36E (B) RH-1 V19E RD11E (B)-Y W06A V09E IS2473H-Y MA26W0 (B) HZ20-V1	

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C 314-xxx-xx) will be available from Commodore at this time.

MAIN PCB ASSEMBLY # GE-1000A (Continued)

LOCATION	DESCRIPTION	JVC PART #	COM PART #
RESISTORS			
R1410	Metal Film, 6.8, 1W, $\pm 5\%$	QRX019J-6R8S	
R1414	Oxide Metal Film, 3.3K, 1W, $\pm 5\%$	QRG019J-332	
R1415	Oxide Metal Film, 2.7K, 1W, $\pm 5\%$	QRG019J-272	
R1421	Oxide Metal Film, 6.8K, 2W, $\pm 5\%$	QRG029J-682	
R1503	Metal Film, 11.8K, 1/4 W, $\pm 1\%$	QRV141F-1182	
R1509	Oxide Metal Film, 10K, 2W, $\pm 5\%$	QRG229J-103	
R1511	Oxide Metal Film, 8.2K, 2W, $\pm 5\%$	QRG229J-822	
R1512	Oxide Metal Film, 8.2K, 2W, $\pm 5\%$	QRG229J-822	
R1514	Oxide Metal Film, 680, 2W, $\pm 5\%$	QRG229J-681	
R1515	Metal Film, 8.2, 1W, $\pm 5\%$	QRX019J-8R2	
R1522	Metal Film, 4.7, 1W, $\pm 5\%$	QRX019J-4R7	
R1523	Oxide Metal Film, 18, 2W, $\pm 5\%$	QRG029J-180	
R1528	Oxide Metal Film, 390, 1W, $\pm 5\%$	QRG019J-391	
R1532	Zinc, 270, $\pm 10\%$	ERZ-C05DK271	
R1703	Metal Film, 41.2K, 1/2W, $\pm 1\%$	QRV121F-4122	
T1704	Metal Film, 9.53K, 1/4W, $\pm 1\%$	QRV141F-9531Y	
VARIABLE RESISTORS			
R1209	1K	QVZ3234-013	
R1303	50K	QVZ3234-054	
R1305	20K	QVZ3234-024	
R1408	220	A76195-221	
R1422	220	A76195-221	
R1428	50K	QVZ3243-054	
R1524	4.7K	A76195-472	
CAPACITORS			
C1202	Tantalum, .47 μ F, 35V, $\pm 20\%$	QEE61VM-474RZ	
C1204	BiPolar Electrolytic, 3.3 μ F, 50V, $\pm 20\%$	QEN61HM-335Z	
C1308	Trimmer Cap		
C1351	BiPolar Electrolytic, 10 μ F, 16V, $\pm 20\%$	QEN61CM-106Z	
C1402	Tantalum, 2.2 μ F, 16V, $\pm 10\%$	QEE61CK-225B	
C1407	Electrolytic, 3.3 μ F, 50K, $\pm 10\%$	QEM41HK-335M	
C1411	Electrolytic, 100 μ F, 160V, +30%, -10%	QET52CR-107	
C1412	Electrolytic, 3.3 μ F, 160V, +30%, -10%	QET52CR-335	
C1508	Polypropylene, 5600 pF, 50V, $\pm 5\%$	QFP31HJ-5625	
C1511	Electrolytic, 47 μ F, 160V, +30%, -10%	QET52CR-476	
C1512	Metalized Polypropylene, 1500 pF, 1600V, $\pm 5\%$	QFZ0082-1525	

* SAFETY COMPONENTS — Use EXACT replacement ONLY.

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MAIN PCB ASSEMBLY # GE-1000A (Continued)

LOCATION	DESCRIPTION	JVC PART #	COM PART #
CAPACITORS (Continued)			
C1513	Metalized Polypropylene, 1500 pF, 1600V, ± 5%	QFZ0082-1525	
C1514	Metalized Polypropylene, 1500 pF, 1600V, ± 5%	QFZ0082-1525	
C1515	Metalized Polypropylene, .53 µF, 200V, ± 10%	QFZ0067-5345	
C1520	BiPolar Electrolytic, 1 µF, 50V, ± 20%	QEN61HM-1052	
C1522	Metalized Polypropylene, 510 pF, 1600V, ± 5%	QFZ0082-5115	
C1523	Electrolytic, 1 µF, 160V, +30%, -10%	QET62CR-105Z	
C1530	Metalized Polypropylene, 510 pF, 1600V, ± 5%,	QFZ-0082 511S	
C1531	Metalized Polypropylene, 1500 pF, 1600V, ± 5%	QFZ-0082-152S	
C1610	BiPolar Electrolytic, .417 µF, 50V, ± 20%	QEN61HM-474Z	
C1612	Electrolytic, 10 µF, 160V, +30%, -10%	QET52CR-106	
C1613	Electrolytic, 10 µF, 160V, +30%, -10%	QET52CR-106	
COILS			
L1201	Peaking 820 µH	A04725-820Z	
L1203	Peaking 270 µH	A04725-270Z	
L1351	Peaking 22 µH	A04725-22Z	
L1352	Peaking 22 µH	A04725-22Z	
L1353	Peaking 22 µH	A04725-22Z	
L1502	Linearity	A39835	
L1503	Width	CJ39503-00A	
L1504	Heater	CJ30030-11	
TRANSFORMER			
T1201	Trap 3.58	A75537-C	
T1301	BP 3.58	CE40191-00A	
T1501	Horizontal Drive	A46022-8M	
T1503	Side Pin	C39084-A	
T1602	SOT	ETA24Z5AY	
OTHER			
DL1201	Delay Line	CE40472-001	
S1201	Lever SW (Service)	CEX40078-001	
Y1301	Crystal	A75746	
FR1401	FR68 ohm, 2W, ± 5%	* QRH021J-680M	* C 314923-01
FR1601	FR100, 1/2W, ± 5%	* QRH127J-101M	* C 314924-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C 314-xxx-xx) will be available from Commodore at this time.

POWER PCB ASSEMBLY #GE-9000A

LOCATION	DESCRIPTION	JVC PART #	COM PART #
TRANSISTORS			
X9101		2SC1890A (E, F)	
X9102		2SC2688 (K, L, M)	
DIODES			
D9101	Silicon	1S1887A	
D9102	Silicon	1S1887A	
D9103	Silicon	1S1887A	
D9104	Silicon	1S1887A	
D9105	Zener	RD6.8EV3-Y	
RESISTORS			
R9103	Metal Film, 4.7, 3W, $\pm 5\%$	QRX039J-4RZ	
R9104	Oxide Metal Film, 10K, 2W, $\pm 5\%$	QRG029J-103A	
R9105	Oxide Metal Film, 18K, 1W, $\pm 5\%$	QRG019J-183S	
R9108	Metal Film, 47K, 1/2W, $\pm 1\%$	QRV121F-4702	
R9110	Metal Film, 3.01K, 1/4 W, $\pm 1\%$	QRV141F-3011Y	
VARIABLE RESISTORS			
R9109	(B ₁ ADJ), 2K B	QVZ3234-023	
CAPACITORS			
C9104	Electrolytic, 330 μ F, 200V, +30%, -10%	QES720R-337M	
C9105	Electrolytic, 10 μ F, 250V, +50%, -10%	QEZ0077-106M	
C9107	Electrolytic, 330 μ F, 200V, +30%, -10%	QES720R-337M	
C9108	Electrolytic, 1 μ F, 160V, +30%, -10%	QET52CR-105	
OTHER			
F9101	Fuse, 1.25A	* QMF51U1-1R25S	* C 314925-01
FR9101	FR 220 ohm, 1/2W, $\pm 5\%$	* QRH127J-221M	* C 314926-01
R9101	Positor	* A75511	

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C 314-xxx-xx) will be available from Commodore at this time.

CRT SOCKET PCB ASSEMBLY #GE-3000A

LOCATION	DESCRIPTION	JVC PART #	COM PART #
TRANSISTOR			
X3101	Silicon	2SC2611	
X3102	Silicon	2SC2611	
X3103	Silicon	2SC2611	
RESISTORS			
R3112	Oxide Metal Film, 12K, 2W, $\pm 5\%$	QRG029J-123	
R3113	Oxide Metal Film, 12K, 2W, $\pm 5\%$	QRG029J-123	
R3114	Oxide Metal Film, 12K, 2W, $\pm 5\%$	QRG029J-123	
R3115	Composition, 3.3K, 1/2W, $\pm 10\%$	QRZ0039-332	
R3116	Composition, 4.7K, 1/2W, $\pm 10\%$	QRZ0039-472	
R3117	Composition, 3.3K, 1/2W, $\pm 10\%$	QRZ0039-332	
VARIABLE RESISTORS			
R3102	B Cut Off, 5K Ω , B	QVZ3234-053	
R3104	R Cut Off, 5K Ω , B	QVZ3234-053	
R3106	G Cut Off, 5K Ω , B	QVZ3234-053	
R3109	R Drive, 220 Ω , B	QVZ3234-022	
R3111	G Drive, 220 Ω , B	QVZ3234-022	
CAPACITORS			
C3101	Electrolytic, 10 μ F, 250V, +50%, -10%	QEZ0077-106M	
C3102	Ceramic, 1000 pF, 3000V, +100%, -0%	QCZ9017-102M	
COILS			
L3101	Peaking, 180 μ H	QQL043K-181	
L3102	Peaking, 390 μ H	A04725-390	
L3103	Peaking, 390 μ H	A04725-390	
L3104	Peaking, 390 μ H	A04725-390	
OTHER			
	CRT Socket	* A75522	* C 314927-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C314-xxx-xx) will be available from Commodore at this time.

CONTROL PCB ASSEMBLY #GE-4000A

LOCATION	DESCRIPTION	JVC PART #	COM PART #
VARIABLE RESISTORS			
R4003	Tint, 10K	CEX40206-B14	
R4004	Color, 10K	CEX40206-B14	
R4006	Cont, 10K	CEX40206-B14	
R4012	Bright, 10K	CEX40206-B14	
R4015	V Hold, 10K	CEX40205-A14	
R4016	H Position, 500	CEX40205-B52	
R4022	Sub Bright, 4.7K	QVZ3507-472	
R4024	Volume, 200K	CEX40205-A25	

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

FUSE PCB ASSEMBLY #GE-9700A

LOCATION	DESCRIPTION	JVC PART #	COM PART #
CAPACITORS			
C9701	Metalized Mylar, .047 μ F, AC125V, \pm 20%	QFZ9008-473M	
C9702	Metalized Mylar, .047 μ F, AC125V, \pm 20%	QFZ9008-473M	
OTHER			
F9701	Fuse 4A Line Filter	* QMF61U1-4R0S A39475-J	* C 314928-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

1701 Schematic Notes

VOLTAGE & WAVEFORM NOTATIONS — Voltage readings and waveform measurements were taken with a color video signal injected at the video input terminal. Figures in () represent voltage readings taken while receiving a black and white sign. Each variable resistor was set to condition at time of shipment. After adjustments have been made, the figures will vary and the figures should be used for reference only.

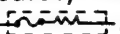
VOLTAGE READINGS — Multimeter set at 20K Ω /volt DC.
All values given are DC voltages.

REFERENCE WAVEFORMS — Scope sweep speed set at:
Hor - 20 μ S/div Vert - 5V/div;
Unless other speed is specified.

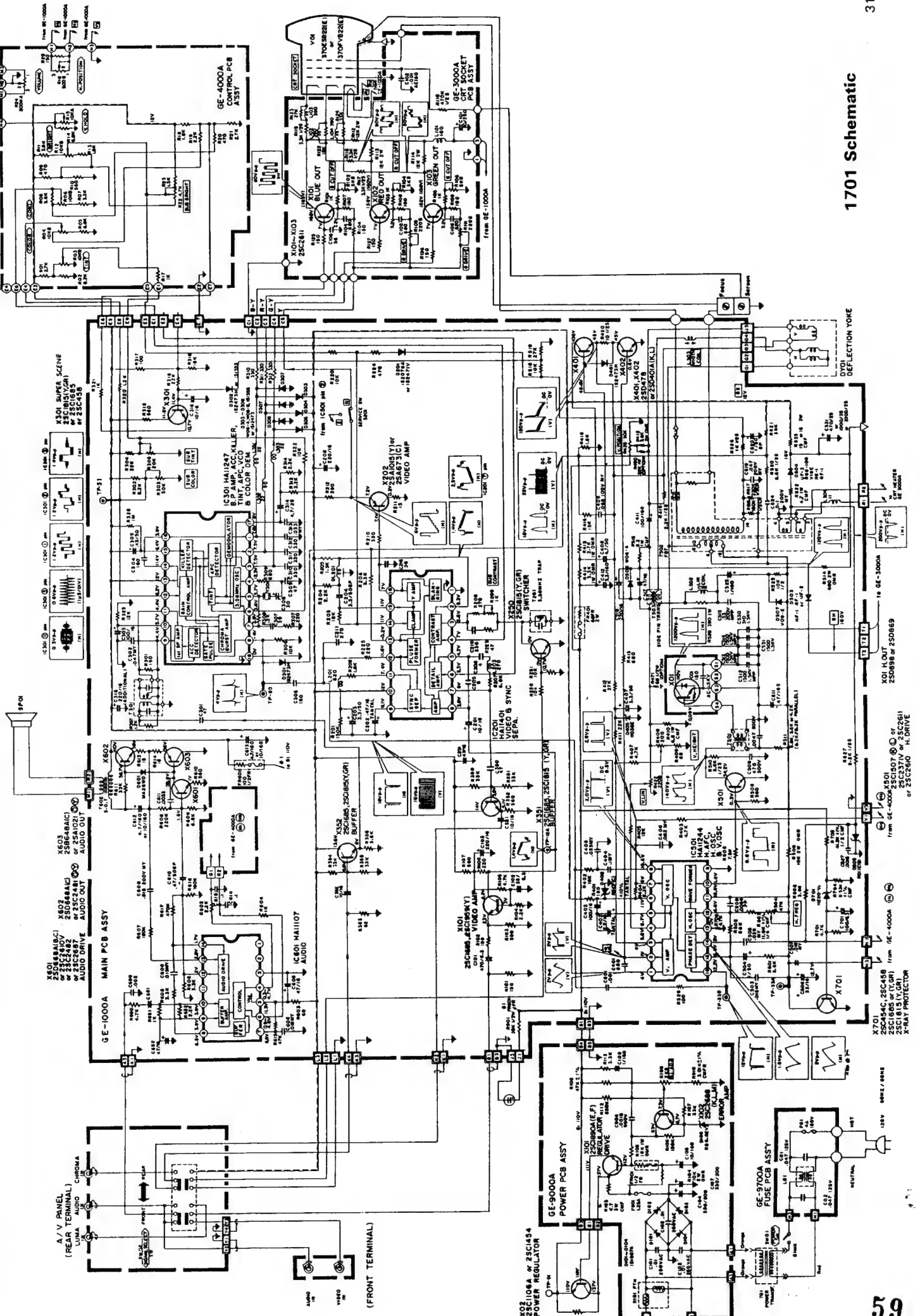
SCHEMATIC NOTES — Unless specified otherwise:

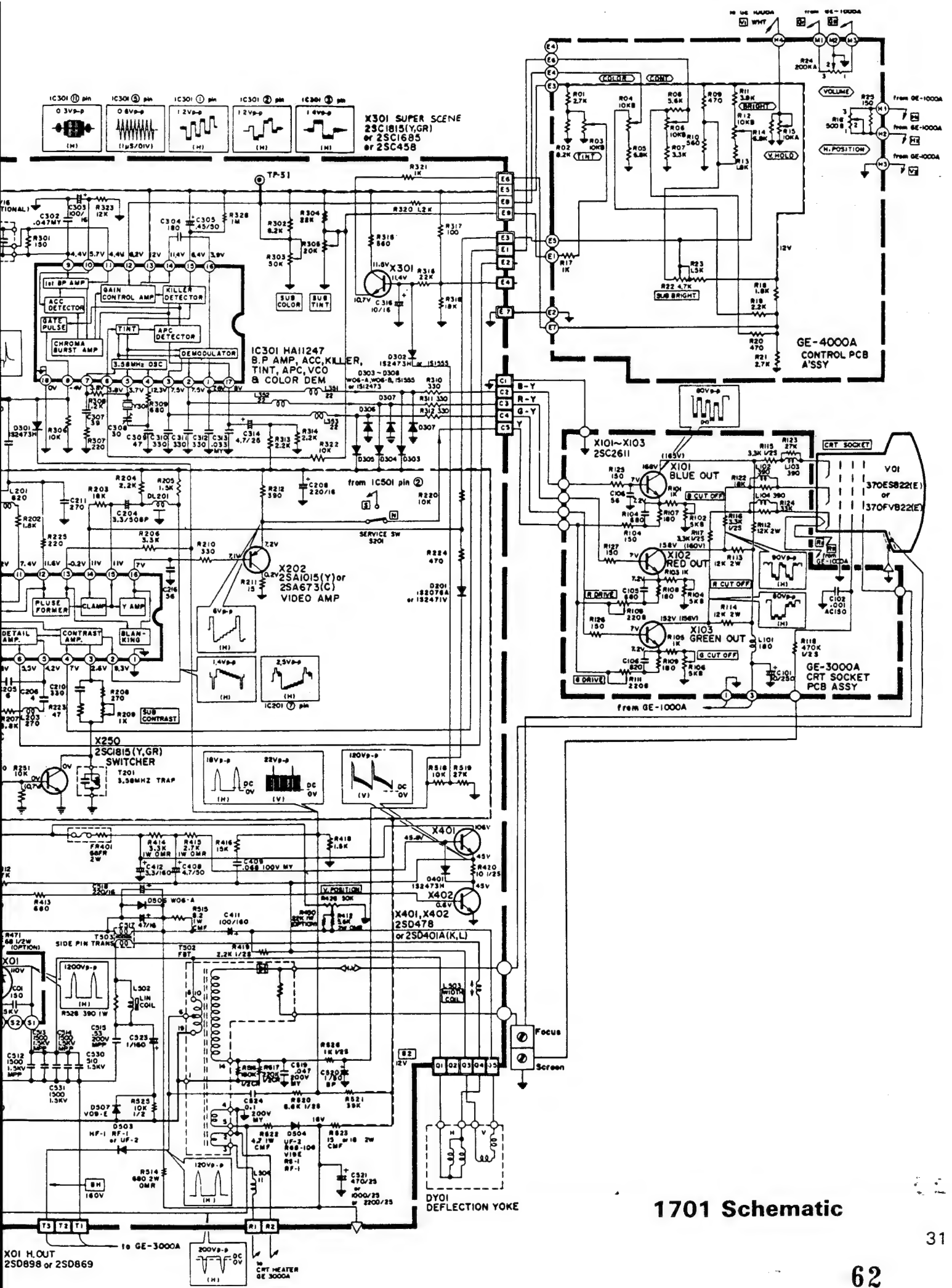
Resistors : All values are in ohms, 1/4 watt carbon
Capacitors: Values of 1 or higher are pF.
Values less than 1 are μ F, 50V, ceramic
Electrolytic values are in μ F, NP indicates non-polar (bipolar)
Inductors: Values are in μ H

⊙ indicates a test point connection
⎓ indicates chassis ground
Hz indicates cycles per second

SAFETY — For safety, maximum reliability, and continued good performance, use specified replacement parts. All safety items have been identified with the symbol *. FR is an abbreviation for FUSIBLE RESISTOR . FR's act like fuses and are used as safety items. They are to be replaced with specified parts.

NOTICE — This circuit diagram and the circuit constants are subject to change for improvement without notice.





TROUBLESHOOTING GUIDE — 1702

Additional information to aid in the troubleshooting of the 1702 monitor has become available from our technical support group. It has been collated into chart form and is being provided to facilitate repairs on this model. The 1702 is the most common monitor in the field at this time.

CHART TERMINOLOGY:

CHECKPOINTS	Point of circuit to be tested
CAUSE	Possible reason for INCORRECT signal or voltage
POSSIBLE SOLUTION	Most likely failure
MISSING	Signal or voltage not present or INCORRECT
PATH	COMPONENTS or TRACES directly related to that portion of the circuit being checked

TIPS:

- When testing IC circuits, always check for proper BIAS and B+ voltages on all legs of the chip.
- An open horizontal oscillator or driver circuit will cause the B1, 125 volt line, to raise to 158 VDC. To troubleshoot this failure, use the DEAD SET, B+ ABNORMAL Chart.
- An improperly regulated B1 will cause a BLOOMING effect. Use the DEAD SET, B+ ABNORMAL to troubleshoot this SYMPTOM.
- When the horizontal oscillator is triple firing, the monitor makes a BUZZING sound and may blow the 1A. FUSE. The horizontal/vertical oscillator chip, IC 501, is the most common problem.
- If the monitor blows the 1A. fuse, it may short out the horizontal output transistor. A common problem is that the 2 matched diodes, D523, test good but actually are shorted.
- A wavy picture and weak video are often repaired by replacing C101, the 470 μ F, 6.3V. cap.

TROUBLESHOOTING GUIDE

Dead Set, B+ Abnormal

NOTE: DC Voltages may be LOWERED due to open ELECTROLYTIC CAPACITORS.

When more than one possible cause is given, follow each DC path back to its SCANNED RECTIFIED SOURCE.

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is F901 open? (4 amp fuse)	Possible short in bridge rectifiers.	Check for shorted diode(s) D901-904, T901 or D905.
Is F902 open? (1 amp fuse)	Possible short in high voltage or excessive load.	Check for shorted Q522, D523 or scan voltage source.
Is voltage at pin 1 of IC901 148 VDC? (voltage regulator)	Possible open path from bridge to regulator.	Check for open R902, R907, or C904 or F902.
Is voltage at pin 2 of IC901 126 VDC? (voltage regulator)	Possible open reference circuit.	Check for open R904, R908, R906 or C907.
Is voltage at pin 4 of IC901 125 VDC? (voltage regulator)	Possible open feed back path or defective chip.	Check for open R901 or IC901.
Is voltage at positive side of C905 18 VDC?	Possible defective bridge.	Check for open or shorted D905.
If the DC fuse (902) is open and no SHORTED parts are readily apparent, then TEMPORARILY jump it out with a 100 watt 125 volt LIGHT BULB. This will absorb MOST OF THE OVER CURRENT ON THE (125) B1 LINE. EXTREME caution should be used in this operation, as some resistors on the scan voltage lines may start to burn due to shorted components.		
LIGHT BULB GLOWS AT 75% INTENSITY		
Is voltage at pin 4 of IC901 or 125 VDC?	High resistance short or short on secondary side of Flyback.	Check Q522 for leakage — CONTINUE to next line.
Is voltage on cathode side of D422 25 VDC?	Defective diode or short on 125V line.	Check D422 for a short or open — CONTINUE to next line.
Is R421 open or BURNING?	Short in 25.8 VDC line.	Check IC421 for a short.

Dead Set, B+ Abnormal (Continued)

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is voltage on cathode side of D522 13 VDC?	Short on 13.8 VDC line.	Open legs on 13.8 volt line until short clears.
Is voltage on cathode side of D551 12 VDC?	Defective diode.	Check D551 for a short or open.
	Short on 12.5 VDC line.	CONTINUE to next line.
Is R551 open or BURNING?	Short on 12.5 VDC line.	Check IC601 for a short.
Is voltage on cathode side of D521 200 VDC?	Defective diode.	Check D521 for a short or open.
	Short on 200 VDC line.	Check line for shorted parts.
NOTE: The above chart may also be used without the light bulb to isolate missing scan voltages.		

No Raster, Sound Normal, High Voltage Normal

NOTE: Make sure that the heaters in the CRT are lit before using this chart.

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is Video signal present at terminal C4?	Improper bias to R-G-B amplifiers.	REFER TO NO VIDEO CHART.
Is 200 VDC at positive side of C351?	No scan voltage.	Check D521 for open or short, L523 for open.
Is 171 VDC at collectors of Q351, Q352, Q353?	Open path from C351 to R-G-B amplifiers.	Check L351, R359, R358 and R357 for open.
Is 400 VDC at pin 8 of CRT?	Missing screen voltage.	Check for open R363, HV bleeder resistor or shorted C352.

No Raster, No Sound, B+ Normal

NOTE: Q501 (X-RAY PROTECTOR) should be checked for proper operation before STARTING with flow chart.

When more than one possible cause is given, follow each DC path back to its SCANNED RECTIFIED SOURCE.

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is Horizontal sawtooth at pin 10 of IC501?	Missing 12.2 DCV pin 11.	Check for proper DC Voltage.
	Possible open IC501.	Replace chip IC501.
Is Horizontal sawtooth at base of Q521?	Missing 0.3 DCV bias.	Check for proper DC Voltage.
	Open bias resistors.	Check R521, R522.
	Open or shorted Transistor.	Check Q521.
Is Horizontal sawtooth at collector of Q521?	Missing 9.5 VDC.	Check for proper DC Voltage. Check T521, R511 or Q521.
	Open or shorted Transistor.	
Is Horizontal sawtooth at base of Q522?	Improper bias reference.	Check for open T521, R524 or Q522
	Open or shorted Transistor.	
Is Horizontal sawtooth at collector of Q522?	Missing 126 VDC.	Check for proper DC Voltage. Check T523 pin 1 & 8, or Q522.
	Open or shorted Transistor.	
NOTE: Continuous shorting of Q522 may be caused by a shorted Flyback transformer or open damping capacitors C526, C534 and C535.		

No Chroma, Sound Normal, Black & White Tracking Normal

NOTE: This chart was written with the FIVE PIN cable installed in the front ports.

When more than one possible cause is given, follow each DC path back to its SCANNED RECTIFIED SOURCE.

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is Chroma signal at pin 7 of IC201?	Missing 7.2 VDC.	Check for proper DC voltage.
	Open IC201.	Replace IC201.
Is Chroma signal at base of Q341?	Missing 5.8 VDC.	Check for proper DC voltage.
	Open path from pin 7 of IC201.	Check R341, R342, C341 or Q341.
Is Chroma signal at emitter of Q341?	Missing 5.1 VDC.	Check for proper DC voltage.
	Open or shorted Q341.	Check DCV at emitter & collector R343.
Is Chroma signal at base of Q342?	Missing 6.2 VDC.	Check for proper DC voltage.
	Open or shorted Q342. Open path from Q341.	Check R346, R347, R345, C343 or AV Switch.
Is Chroma signal at emitter of Q342?	Missing 5.5 VDC.	Check for proper DC voltage.
	Open or shorted Q342.	Check R348. Replace Q342.
Is Chroma signal at pin 9 of IC301?	Missing 12 VDC pin 13.	Check for proper DC voltage.
	Open path from Q342.	Check C301, R324, T301 or R301. Replace IC301.
Is ADJUSTABLE 5.5 VDC at pin 12 of IC301?	Open Chroma or sub Chroma controls or DC voltages.	Check voltages from control PCB assembly.
	Open path from AV PCB.	Check R303, R302 or IC301.
Is horizontal keying pulse at pin 8 of IC301?	Open path from pin 11 of T523.	Check for open D301, R228, R529, R537 or C533.
Is 3.58 MHz signal at pin 5 of IC301?	Open oscillator circuit.	Check for open X301, C308, C309, C307, R307, R308 and R309 or replace IC301.
Are Chroma signals at bases of Q351, Q352 and Q353?	Open path from IC301.	Check for open L301, L302, L303, R310, R311, R312, R373, R374, R375 or shorted C311, C312 and C313.
	Defective output IC301.	Check IC301.

No Video, Sound Normal, Raster Normal

NOTE: A common error made is that the AV slide switch is in the wrong position.

When more than one possible cause is given, follow each DC path back to its SCANNED RECTIFIED SOURCE.

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is video signal at emitter of Q101?	Open path from AV terminal.	Check for open C101, R101, R102.
Is video signal at collector of Q101?	Missing 7.6 VDC.	Check for proper DC voltage.
	Open or shorted component transistor circuit.	Check R106, R107, C103 or Q101.
	Open or shorted transistor.	Check Q101.
Is video signal at pin 8 of IC201?	Open path from Q101 to IC201.	Check C201 for open.
Is video signal at pin 2 of IC201?	Missing 9 VDC.	Check for proper DC voltage.
	Open IC201.	Replace IC201.
Is video signal at pin 15 of IC201?	Missing 10 VDC.	Check for proper DC voltage.
	Open path from pin 2 of IC201.	Check for open DL201, C204.
Is Horizontal blanking pulse on pin 13 of IC201?	Open path from pin 11 of Flyback Transformer.	Check for open R206, R228, R529, R537 and C533.
Is video signal at pin 16 of IC201?	Improper voltages on pin 14 of IC201.	Check voltages from control PCB assembly.
	Open IC201.	Replace IC201.
Is video signal at base of Q201?	Open path from pin 16 of IC201.	Check for open R210 and R230.
Is video signal at emitter of Q201?	Missing emitter voltage or base bias voltage.	Check for proper DC voltages.
	Open Q201.	Replace Q201.
Is video signal at point C4 on CRT PCB?	Open path from emitter of Q201 to terminal C4.	Check for open service switch or wire.

No Sound, Video Normal

When more than one possible cause is given, follow each DC path back to its SCANNED RECTIFIED SOURCE.

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is audio signal at pin 2 of IC601?	Missing 5.4 VDC.	Check IC601.
	Open path from AV terminal.	Open R601 and C601.
Is (ADJUSTABLE) 3 VDC at pin 4 of IC601?	Missing 3 VDC.	Check for proper DC voltage.
	Open path from control PCB assembly.	Open R608, R871 or R872.
Is audio signal at pin 8 of IC601?	Missing 12.5 VDC pin 9.	Check for proper DC voltage.
	Missing 11.8 VDC pin 1.	Check for proper DC voltages.
	Defective filter/feed back circuit.	Check for open R604, R606 or open or shorted C603, C604 or C605.
	Defective IC601.	Check IC601.
Is audio signal at point M1?	Open path from IC601 to speaker.	Check open or shorted C607 or open or shorted speaker.

No Vertical Sweep

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is vertical signal at pin 5 of IC501?	Missing 11.3 VDC on pin 6	Check for proper DC voltage.
	Possible open chip.	Replace chip.
Is vertical signal at pin 2 of IC501?	Open feed back path from IC421.	Check for proper DC voltage at IC421.
	Defective IC421.	Replace IC421 or IC501.
Is vertical signal at pin 2 of IC421?	Missing 26 VDC pin 3 or 25.8 VDC pin 7.	Check for proper DC voltage.
	Defective IC421.	Replace IC421.
Is vertical signal at V1 and V2?	Open path from output of IC421 to ground.	Check for open yoke or C424, R422, R410.
NOTE: The vertical amplifier in IC501 is supported by a feed back signal from pin 2 of IC421 to pin 3 of IC501. If this signal is not present, the vertical amp in IC501 will not bias on. Check feed back resistors and capacitors carefully.		

Cannot Set Black & White Tracking

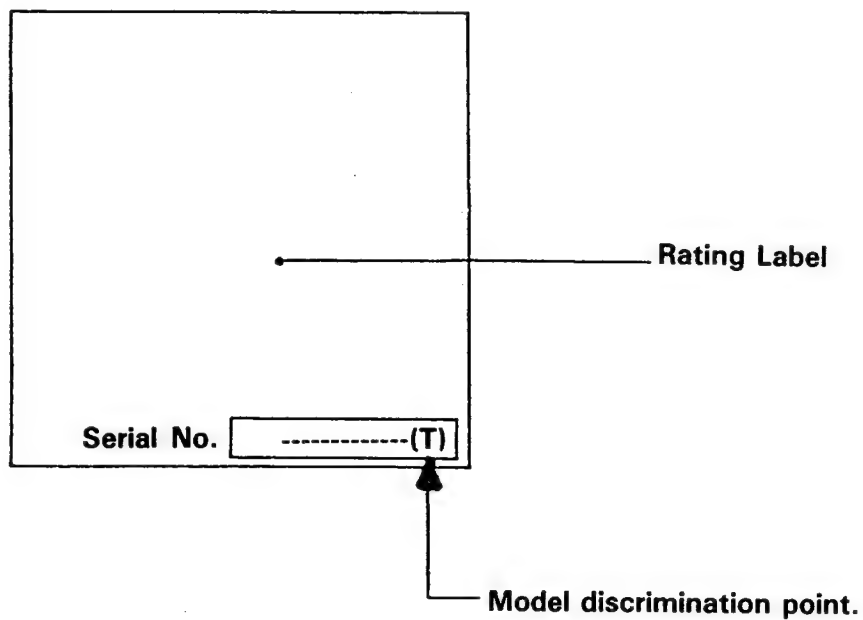
NOTE: Improper color will be evident in this condition.

CHECKPOINT	CAUSE	POSSIBLE SOLUTION
Is video signal present at terminal C4?	Improper bias to R-G-B amplifiers.	REFER TO NO VIDEO CHART.
Is 6.9 VDC at bases of Q351, Q352 & Q353?	Open path from IC301.	REFER TO NO CHROMA CHART.
	Open or shorted transistors.	Replace defective transistor.
Is 171 +/- VDC at collectors of Q351, Q352, Q353?	Open path from C351 to R-G-B amplifiers.	Check L351, R359, R358, R357 and C351 for open.
Is 140 VDC at pins 3, 7 and 9 of the CRT?	Improper cathode bias.	Check for open R360, R361 and R362.
Is 200 VDC at positive side of C351?	No scan voltage.	REFER TO NO RASTER CHART.

1702 MODEL IDENTIFICATION

BEFORE servicing a 1702 Monitor, please NOTE:

Some models are distinguished with the letter "T" next to the manufacturer's serial number.



This designation indicates that a TOSHIBA picture tube and deflection yoke were used. A difference in electrical specifications is required. The connect schematic and parts list is identified 1702 "T".

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part number (C 314-xxx-xx) will be available from Commodore at this time.

1702 CHASSIS PARTS

LOCATION	DESCRIPTION	JVC PART #	COM PART #
DY01	Deflection Yoke	* CJ26161-00A	* C 314929-01
J1821	US Pin Jack Vid In	C39207-004	
J1822	US Pin Jack Aud In	C39207-003	
L01	Degaussing Coil	* A39477-T	
Q1522	Silicon Transistor	* 2SD1426	* C 314930-01
R01	Unflammable Resistor, 280Ω, 20W, ± 10%	* QRF208K-281	* C 314931-01
S01	Power Switch	* CEX40097-002	* C 314918-01
SP01	Speaker 8Ω, 2W	EAS-10P225S	
T01	HV Module	* CJ26156-00B	* C 314932-01
V01	Picture Tube	* 370FVB22(E)	
	PC Magnet	CE40305-00B	
	Neon Lamp	QLZ9015-001	

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

1702 CABINET PARTS

LOCATION	DESCRIPTION	JVC PART #	COM PART #
1701/1702	Front Cabinet		C 314900-01
1701/1702	Front Control Panel Door		C 314901-01
1701/1702	Power Button		C 314902-01
1702	Front Name Plate		C 314903-02
1701/1702	RT Side Handle		C 314904-01
1701/1702	LT Side Handle		C 314905-01
1701/1702	Rear Cabinet		C 314906-01
1701/1702	Rear A/V Terminal Assembly		C 314907-01
1701/1702	Top Cabinet Panel		C 314908-01
1701/1702	Replacement AC Cord	* QMP1460-244K	* C 314909-01
1702	Users Manual		C 314910-02
1701/1702	Logo Nameplate		C 314911-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C 314xxx-xx) will be available from Commodore at this time.

MAIN PCB ASSEMBLY # GE-1003A

LOCATION	DESCRIPTION	JVC PART #	COM PART #
INTEGRATED CIRCUITS			
IC1201 IC1301 IC1421 IC1501 IC1601		HA11401 HA11247 AN5515 HA11244 AN5265	
TRANSISTORS			
Q1101 Q1201 Q1251 Q1301 Q1341 Q1342 Q1501 Q1521 Q1522		2SC1959 (Y) 2SA1015 (Y, GR) 2SC1815 (Y, GR) 2SC1815 (Y, GR) 2SC1815 (Y, GR) 2SC1815 (Y, GR) 2SA1015 (Y, GR) 2SC1627A * 2SD1426	* C 314930-01
DIODES			
D1201 D1202 D1204 D1301 D1302 D1401 D1421 D1422 D1501 D1502 D1503 D1522 D1523 D1524 D1525 D1541 D1551	Zener Zener Zener	1SS133 W06B 1SS133 1S1555 1SS133 MA4110 (M) 1SR124-400 1SR124-400 MA4110 (M) 1SS81 1SS133 1SR124-400 RM-2C U19E MA4220 (M) 1SR124-400 1SR124-400	

* SAFETY COMPONENTS — Use EXACT replacement ONLY.

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C 314-xxx-xx) will be available from Commodore at this time.

MAIN PCB ASSEMBLY # GE-1003A (Continued)

[illegible]

***SAFETY COMPONENTS — Use EXACT replacement ONLY.**

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C 314-xxx-xx) will be available from Commodore at this time.

MAIN PCB ASSEMBLY # GE-1003A (Continued)

LOCATION	DESCRIPTION	JVC PART #	COM PART #
CAPACITORS (Continued)			
C1423	Electrolytic, 100 μ F, 35V	* QET51VR-107	* C 314935-01
C1425	Electrolytic, 470 μ F, 35V	* QET51VR-477	* C 314936-01
C1426	TF, .15 μ F, 50V	QFV81HJ-154M	
C1502	Electrolytic, 220 μ F, 35V, +30%, -10%	* QET51VR-227	* C 314937-01
C1508	Polypropylene, 5600 pF, 100V	QFP32AJ-562M	
C1523	Electrolytic, 33 μ F, 160V	* QET52CR-336	* C 314938-01
C1526	Metalized Polypropylene, 5000 pF, 1600V	* QFZ0081-5001S	* C 314939-01
C1529	Metalized Polypropylene, .53 μ F, 200V	QFZ0067-534S	
C1530	Electrolytic, 2.2 μ F, 50V	QEN61HM-225Z	
C1531	Electrolytic, 470 μ F, 25V, +30%, -10%	* QET51ER-477	* C 314940-01
C1534	Metalized Polypropylene, 1500 pF, 1600V, \pm 3%	* QFZ0081-1501S	* C 314941-01
C1535	Mylar, .082 μ F, 100V, \pm 10%	* QFM72AK-823M	* C 314942-01
C1541	Electrolytic, 1 μ F, 160V, +30%, -10%	QET62CR-105Z	
C1551	Electrolytic, 1000 μ F, 16V, +30%, -10%	* QET51CR-108	* C 314943-01
COILS			
L1201	Peaking Coil, 820 μ H	A76186-820Z	
L1203	Peaking Coil, 270 μ H	A76186-270Z	
L1301	Peaking Coil, 22 μ H	A76186-22Z	
L1302	Peaking Coil, 22 μ H	A76186-22Z	
L1303	Peaking Coil, 22 μ H	A76186-22Z	
L1521	Lin. Coil	* CE40052-001	
L1522	W. Coil	* CE40140-00F	
L1523	HVT Choke	CE40037-560	
L1524	Heater Choke	CJ30030-100	
TRANSFORMERS			
T1201	Trap, 3.58 MHz	A75537-0	
T1301	BP, 3.58 MHz	CE40476	
T1521	SW Drive	* CE40361-00B	* C 314944-01
MISCELLANEOUS			
DL1201	Delay Line	CE40535-001	
S1201	Service Switch (Lever)	CEX40078-001	
X1301	Crystal	A76351-D	

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part numbers (C 314xxx-xx) will be available from Commodore at this time.

CONTROL PCB ASSEMBLY #GE-1003A (4/6)

LOCATION	DESCRIPTION	JVC PART #	COM PART #
VARIABLE RESISTORS			
R1854	Cont, 10K	CEX40206-B14	
R1860	Bright, 10K	CEX40206-B14	
R1863	Sub Bright, 4.7K	QVZ3507-472	
R1866	Tint, 10K	CEX40206-B14	
R1869	Color, 10K	CEX40206-B14	
R1871	Volume, 10K	CEX40205-B14	
R1875	V. Hold, 10K	CEX40205-A14	
R1877	H. Position, 1K	CEX40205-B13	
MISCELLANEOUS			
L1851	Peaking Coil, 820 μ H	A76186-820Z	
SW1821	Slide Switch (Signal Select)	CEX40325-001	
J1821	US Pin Jack (Video In)	C39207-004	
J1822	US Pin Jack (Audio In)	C39207-003	

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part number (C 314xxx-xx) will be available from Commodore at this time.

CRT SOCKET PCB ASSEMBLY # GE-1003A (3/6)

LOCATION	DESCRIPTION	JVC PART #	COM PART #
TRANSISTORS			
Q1351 Q1352 Q1353		2SC2611 2SC2611 2SC2611	
DIODES			
D1351	Silicon	1RM-2C	
RESISTORS			
R1357- R1359 R1360- R1362 R1378	Oxide Metal Film, 12K Composition, 3.3K ZN	QRG029J-123 QRZ0039-332 ERZ-C05ZK271	
VARIABLE RESISTORS			
R1352 R1354 R1356 R1369 R1371	B Cut Off, 5K R Cut Off, 5K G Cut Off, 5K R Drive, 200 G Drive, 200	CEX40302-053 CEX40202-053 CEX40202-053 CEX40202-022 CEX40202-022	
CAPACITORS			
C1351 C1352 C1356	Electrolytic, 4.7 μ F, 250V Ceramic, 1000 pF, 3K V Electrolytic, 4.7 μ F, 250V	* QET52ER-475 QCZ9017-102M QET52ER-475	* C 314945-01
MISCELLANEOUS			
L1351	Peaking Coil, 180 μ H CRT Socket	QQL043K-181 * CE40085-00A	* C 314946-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part number (C 314xxx-xx) will be available from Commodore at this time.

REGULATOR PCB ASSEMBLY # GE-1003A (2/6)

LOCATION	DESCRIPTION	JVC PART #	COM PART #
INTEGRATED CIRCUITS			
IC1901		* STR3125	* C 314947-01
DIODES			
D1504	Bridge Rectifier	* 1B4B42	* C 314948-01
D1901- D1904	Silicon	* 1S1887A	* C 314949-01
RESISTORS			
R1902	Non-flammable, 2, 7W	* QRF076K-2R0	* C 314950-01
R1907	Metal Film, 4.7, 2W	* QRX029J-4R7A	* C 314951-01
R1910	Composition, 6.8M, 1/2W	QRZ0039-685	
CAPACITORS			
C1901- C1903	Ceramic, 4700 pF	* QCZ9021-472U	* C 314952-01
C1904	Electrolytic, 470 μF, 200V, ±20%	* QEU720M-477M	
C1906	Metal Film, .1 μF	* QFZ9020-104M	
C1907	Electrolytic, 10 μF, 160V, +30%, −10%	QET52CR-106	
C1908	Metal Film, .1 μF	QFZ9020-104M	
C1910- C1911	Ceramic, .1 μF	QCZ9020-472M	
MISCELLANEOUS			
L1901	Coil — Line Filter	* CE40247-00A	* C 314953-01 * C 314954-01 * C 314955-01 * C 314956-01
T1901	Power Transformer	* CE40489-00A	
F1901	Fuse, 4A	* QMF66U1-4R0S	
F1902	Fuse, 1A	* QMF66U1-1R0S	
TH1901	Thermistor	* CEX40137-001	

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

1702 Schematic Notes

VOLTAGE & WAVEFORM NOTATIONS — Voltage readings and waveform measurements were taken with a color video signal injected at the video input terminal. Each variable resistor was set to condition at time of shipment. After adjustments have been made, the figures will vary and the figures should be used for reference only.


VOLTAGE READINGS — Multimeter set at 20K Ω /volt DC.
All values given are DC voltages.

REFERENCE WAVEFORMS — Scope sweep speed set at:
Hor - 20 μ S/div Vert - 5V/div;
Unless other speed is specified.

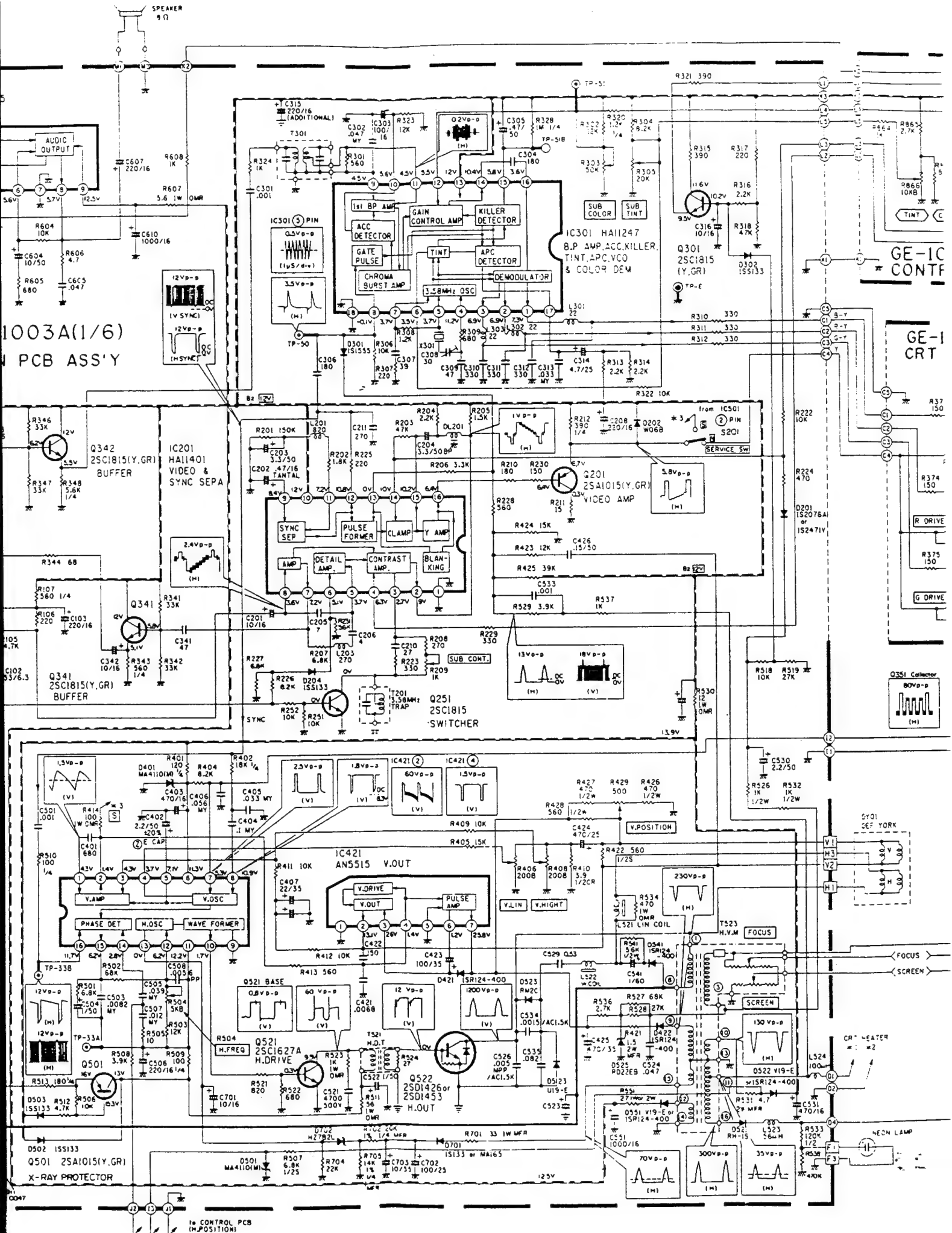
SCHEMATIC NOTES — Unless specified otherwise:

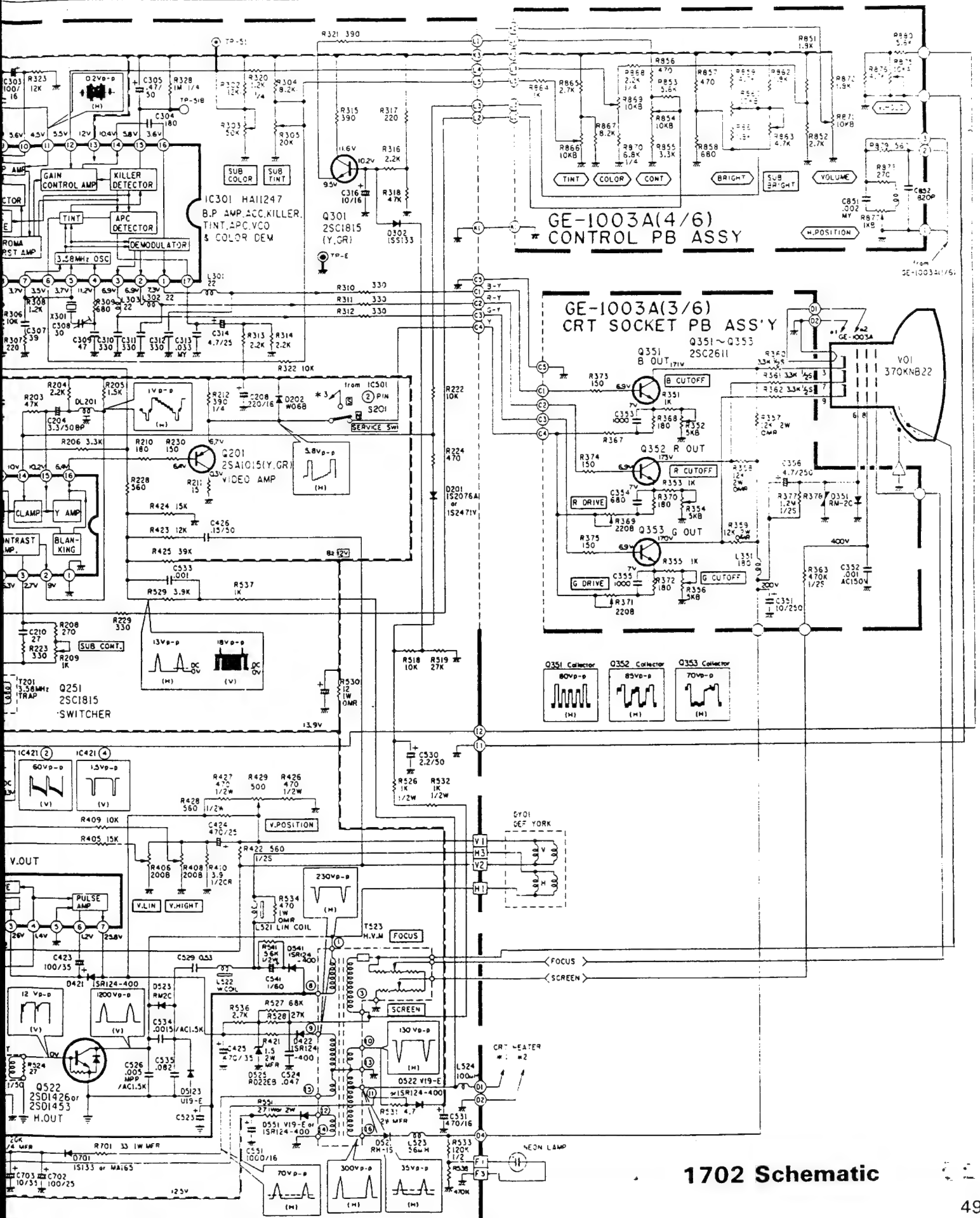
Resistors : All values are in ohms, 1/6 watt carbon.
Capacitors: Values of 1 or higher are pF.
Values less than 1 are μ F, 50V, ceramic.
Electrolytic values are in μ F, NP indicates non-polar (bipolar).
Inductors: Values are in μ H.

⊙ indicates a test point connection
⎓ indicates chassis ground
Hz indicates cycles per second

SAFETY — For safety, maximum reliability, and continued good performance, use specified replacement parts. All safety items have been identified with the symbol *. FR is an abbreviation for FUSIBLE RESISTOR . FR's act like fuses and are used as safety items. They are to be replaced with specified parts.

NOTICE — This circuit diagram and the circuit constants are subject to change for improvement without notice.





1702 Schematic

1702T Unique Parts

Monitor parts may be secured locally. JVC part numbers have been provided for your convenience. ONLY Commodore part number (C 314xxx-xx) will be available from Commodore at this time.

1702T

LOCATION	DESCRIPTION	JVC PART #	COM PART #
CHASSIS PARTS			
V01 DY01	Picture Tube Def. Yoke	* 370NVB22-AB * CE20037-00A	* C 314957-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

MAIN PCB ASSEMBLY #GE-1005A

LOCATION	DESCRIPTION	JVC PART #	COM PART #
DIODES			
D1402 D1521		RD6.8E (B) * RH-1S	* C 314958-01
RESISTORS			
R1421 R1533	Metal Film, 6.8, 2W, $\pm 5\%$ Ceramic, 120K, 1/2W, $\pm 5\%$	* QRX029J-6R8A * QRD121J-124SY	* C 314959-01
VARIABLE RESISTORS			
R1305	Sub Tint, 5K	QVZ3230-053	
CAPACITORS			
C1526	Metalized, Polypropylene, 6300 pF, 1600V, +3%	* QFZ0081-6301S	* C 314960-01

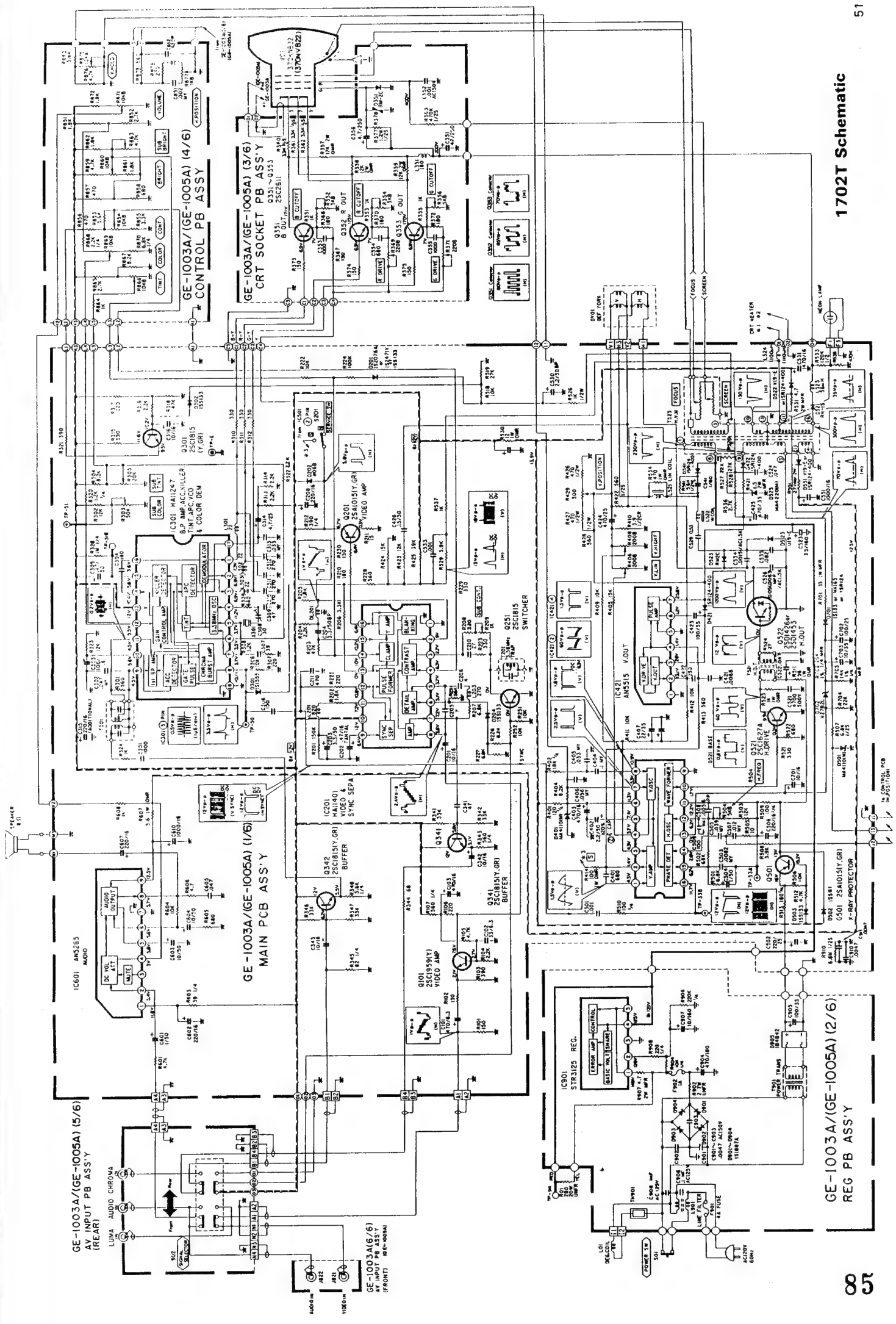
*SAFETY COMPONENTS — Use EXACT replacement ONLY.

REG. PCB ASSEMBLY #GE-1005A

LOCATION	DESCRIPTION	JVC PART #	COM PART #
RESISTORS			
R1904	Ceramic, 10K, 1/2W, $\pm 5\%$	* QRD1295-103S	* C 314961-01

*SAFETY COMPONENTS — Use EXACT replacement ONLY.

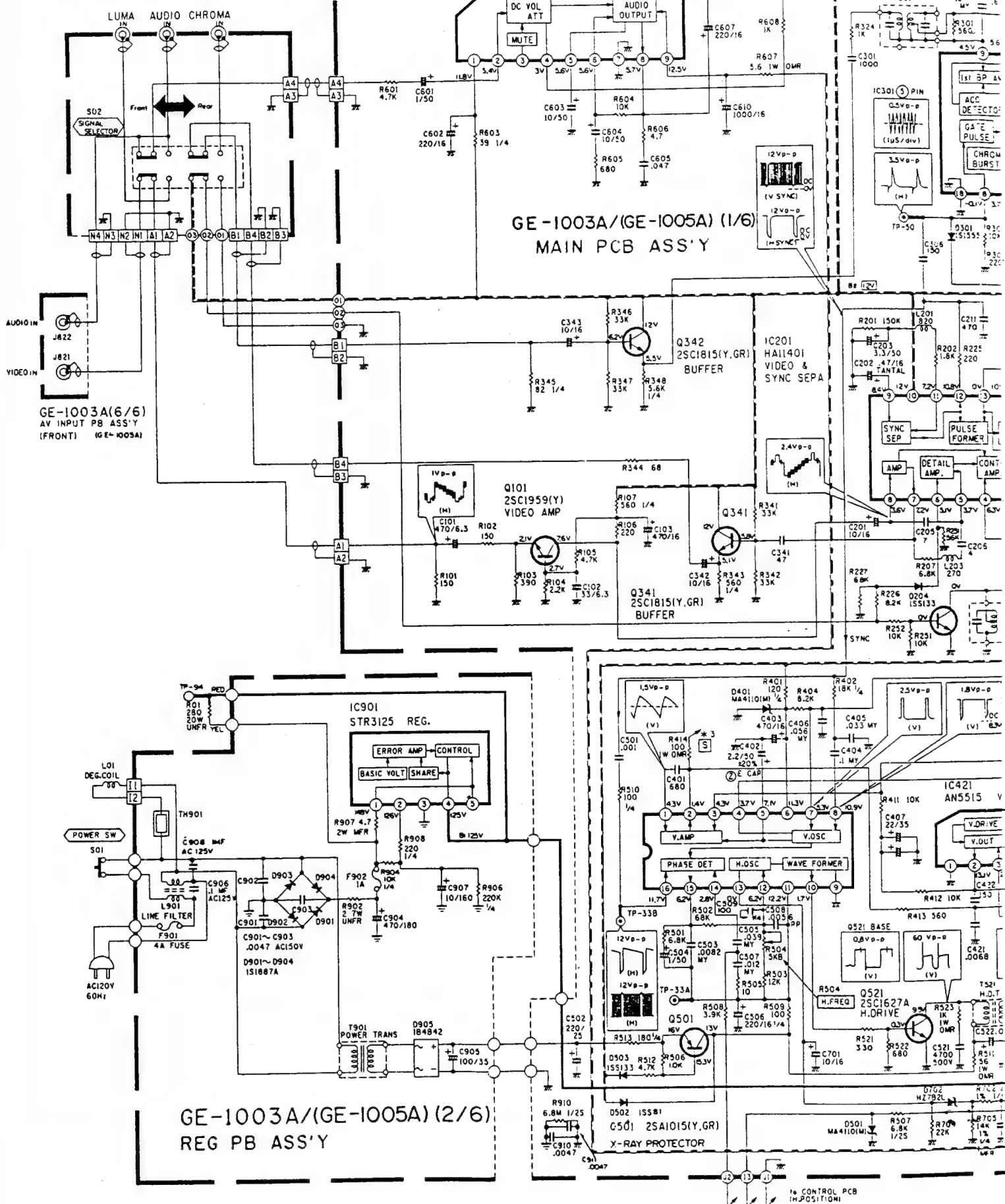
1702T Schematic

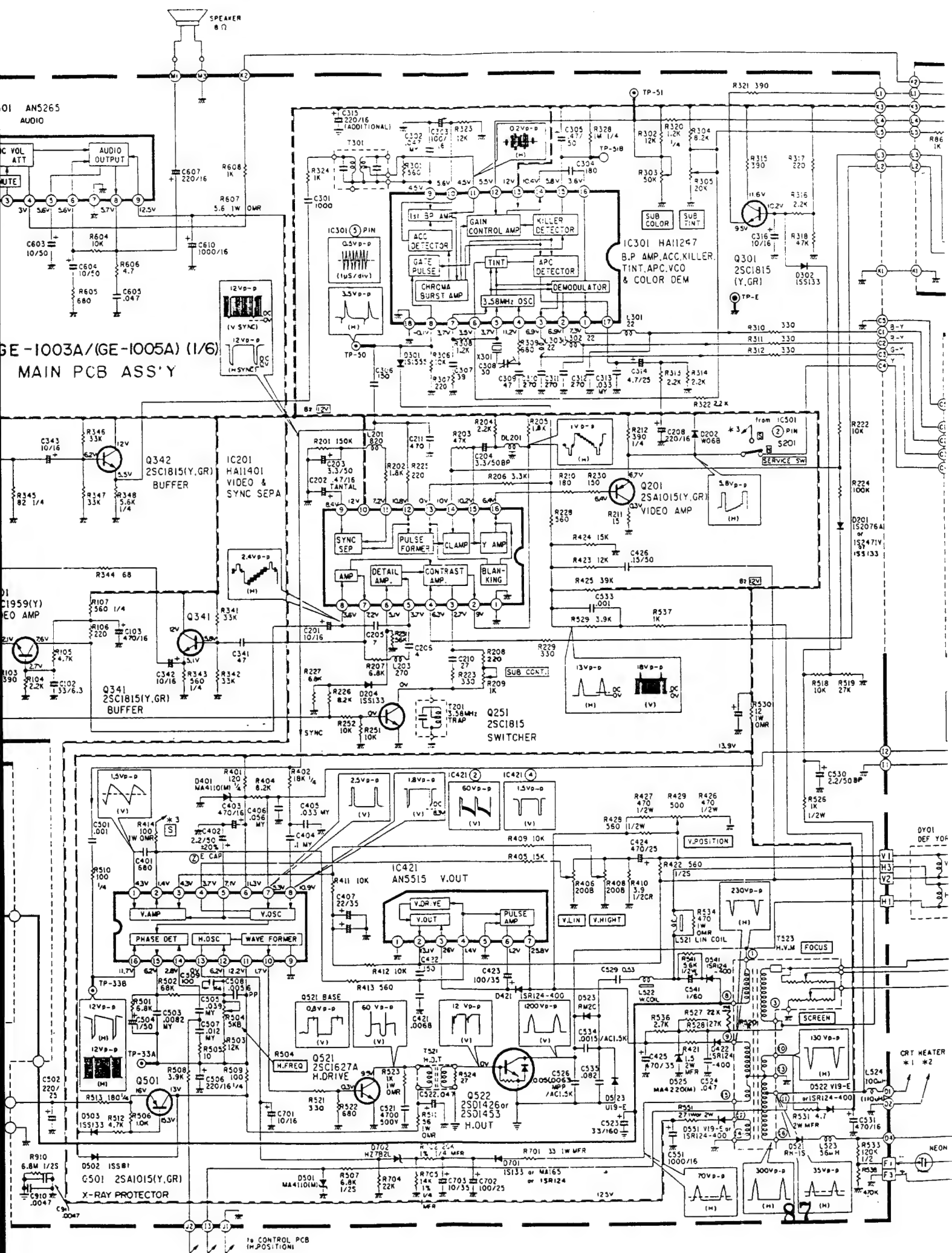


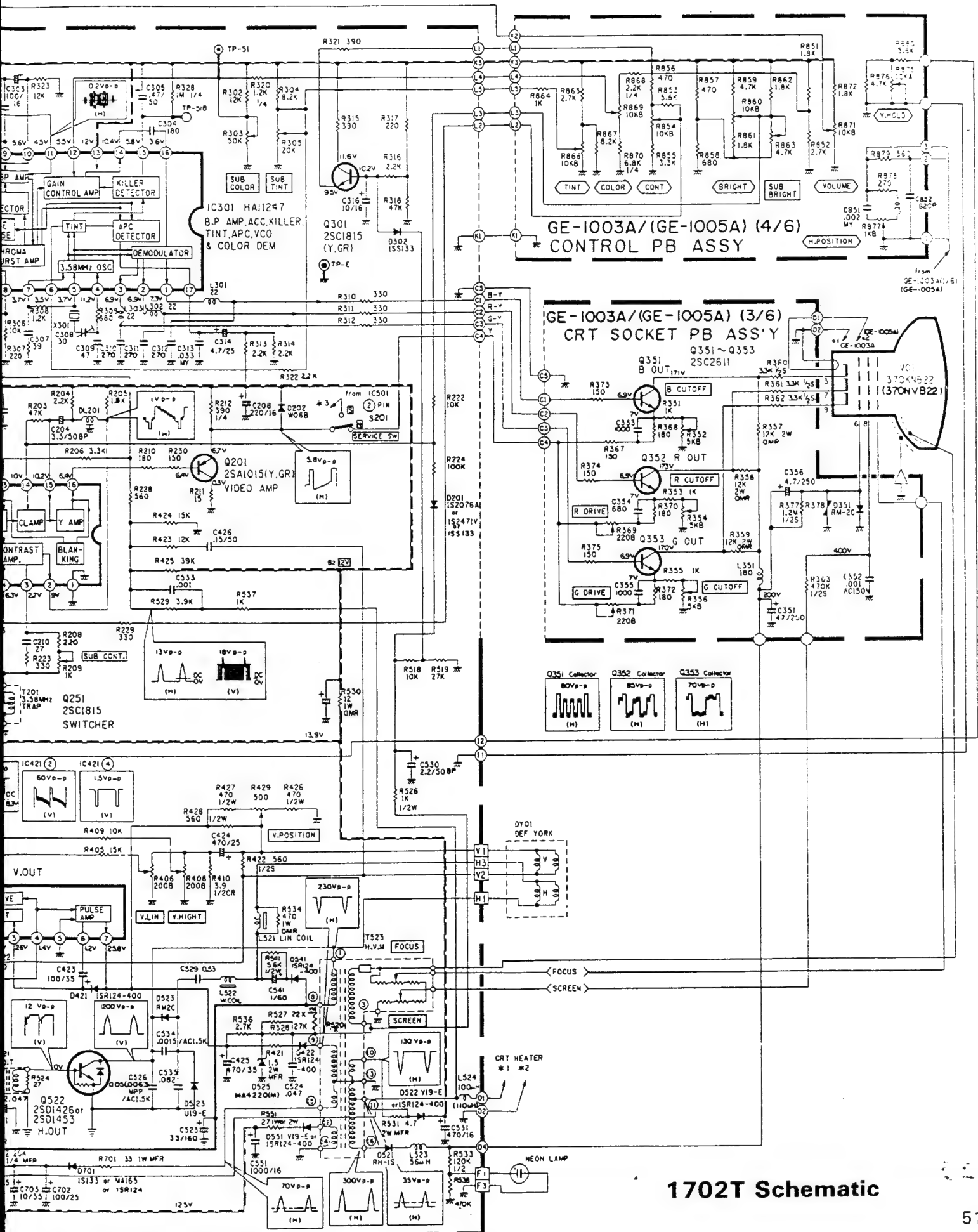
GE-1003A/(GE-1005A) (5/6)
AV INPUT PB ASS'Y
(REAR)

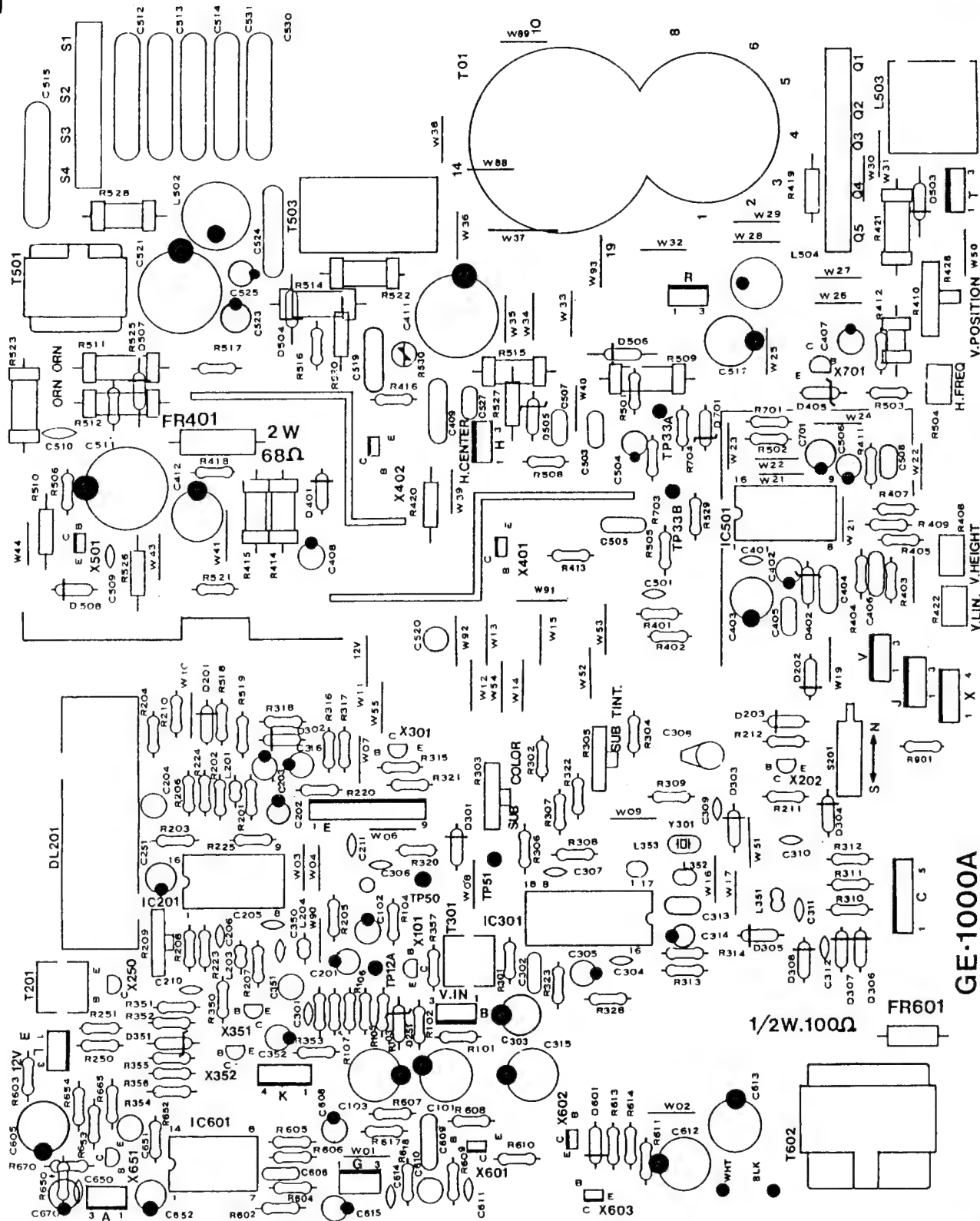
IC601 AN5265
AUDIO

GE-1003A/(GE-1005A) (1/6)
MAIN PCB ASS'Y

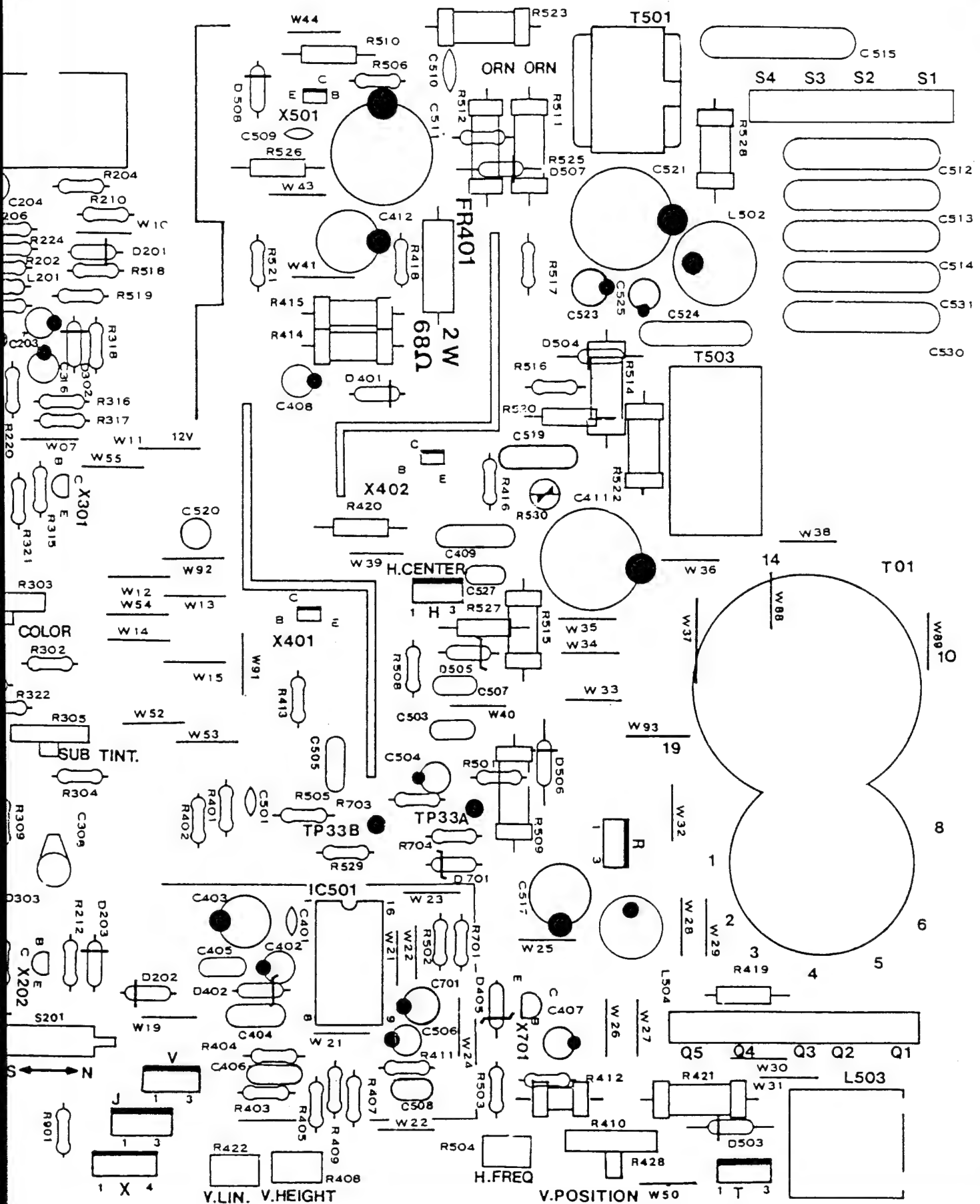


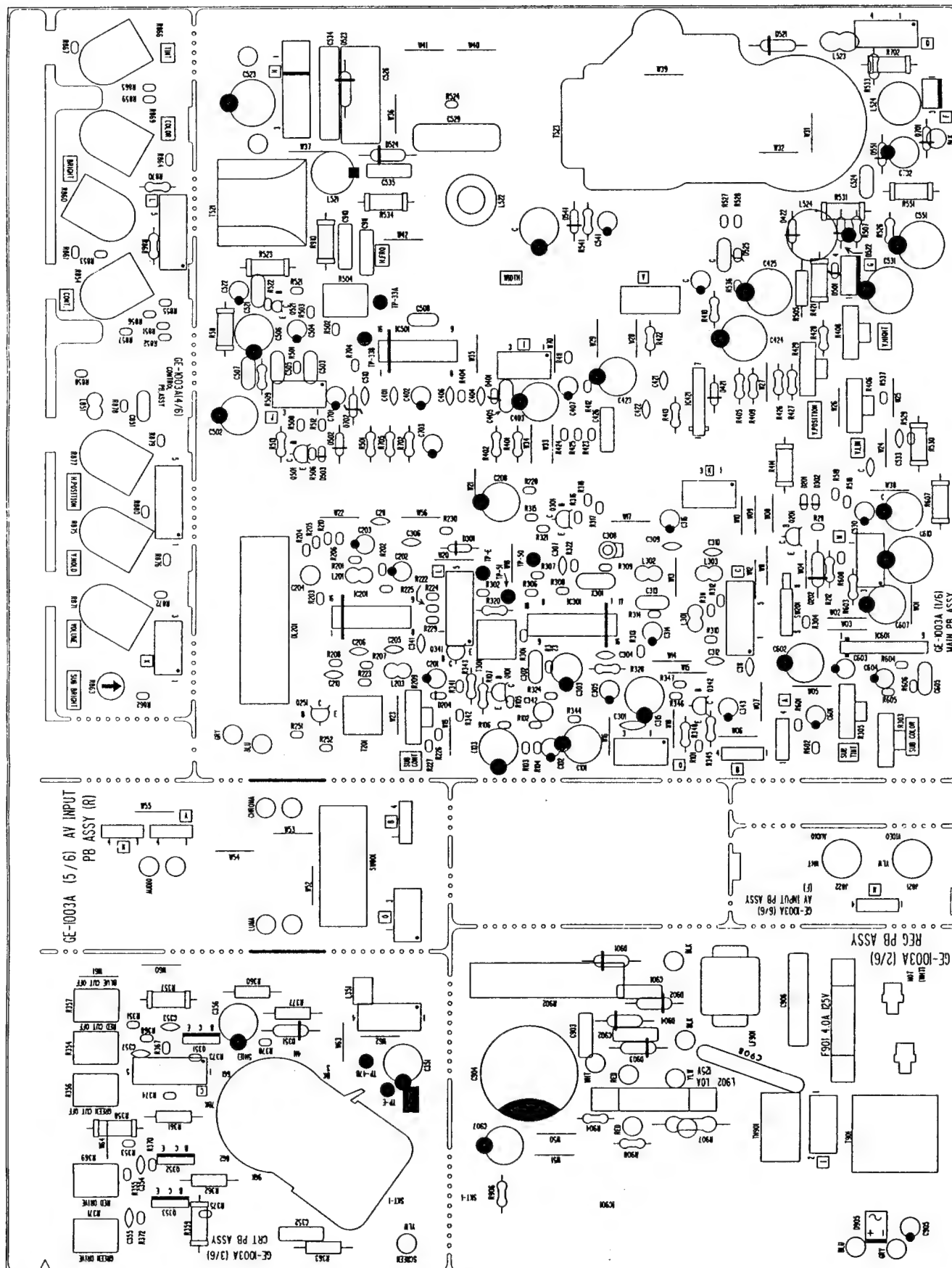


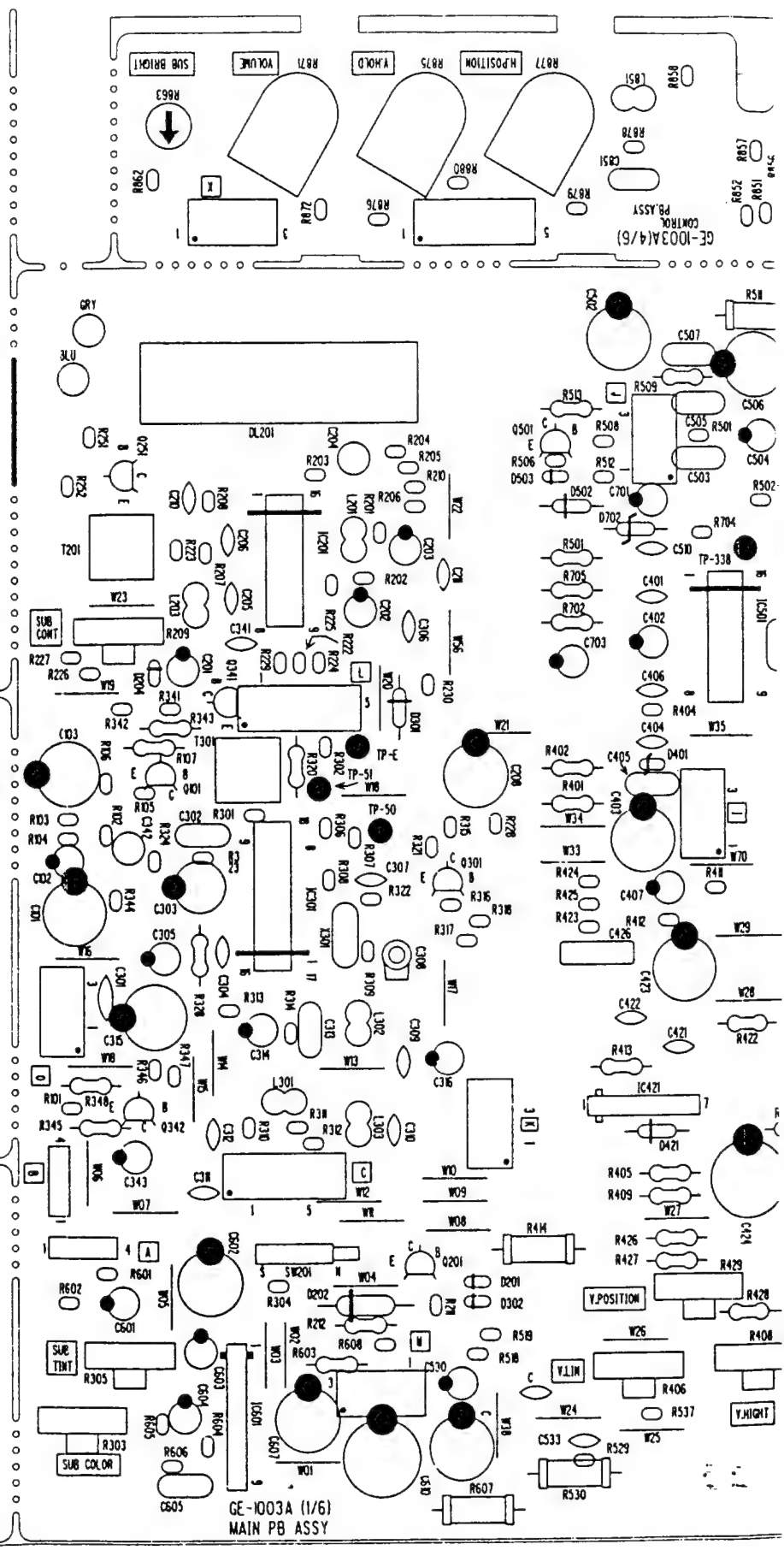
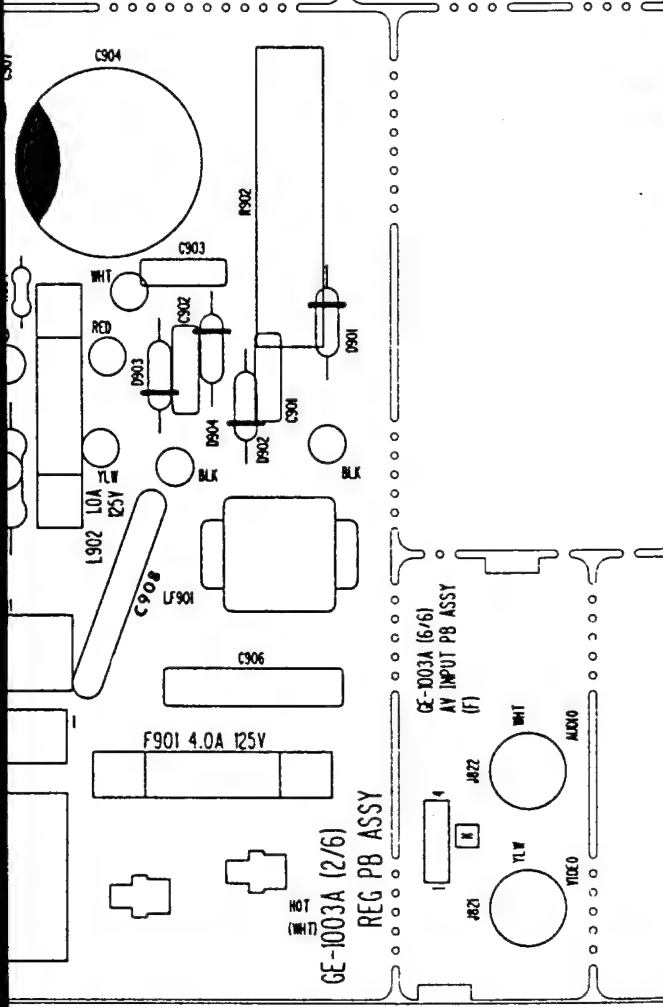
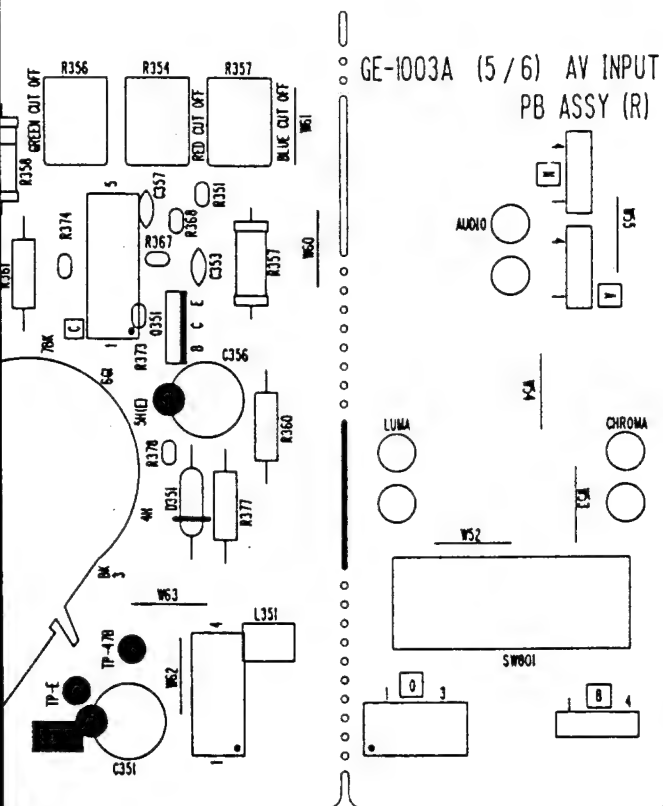




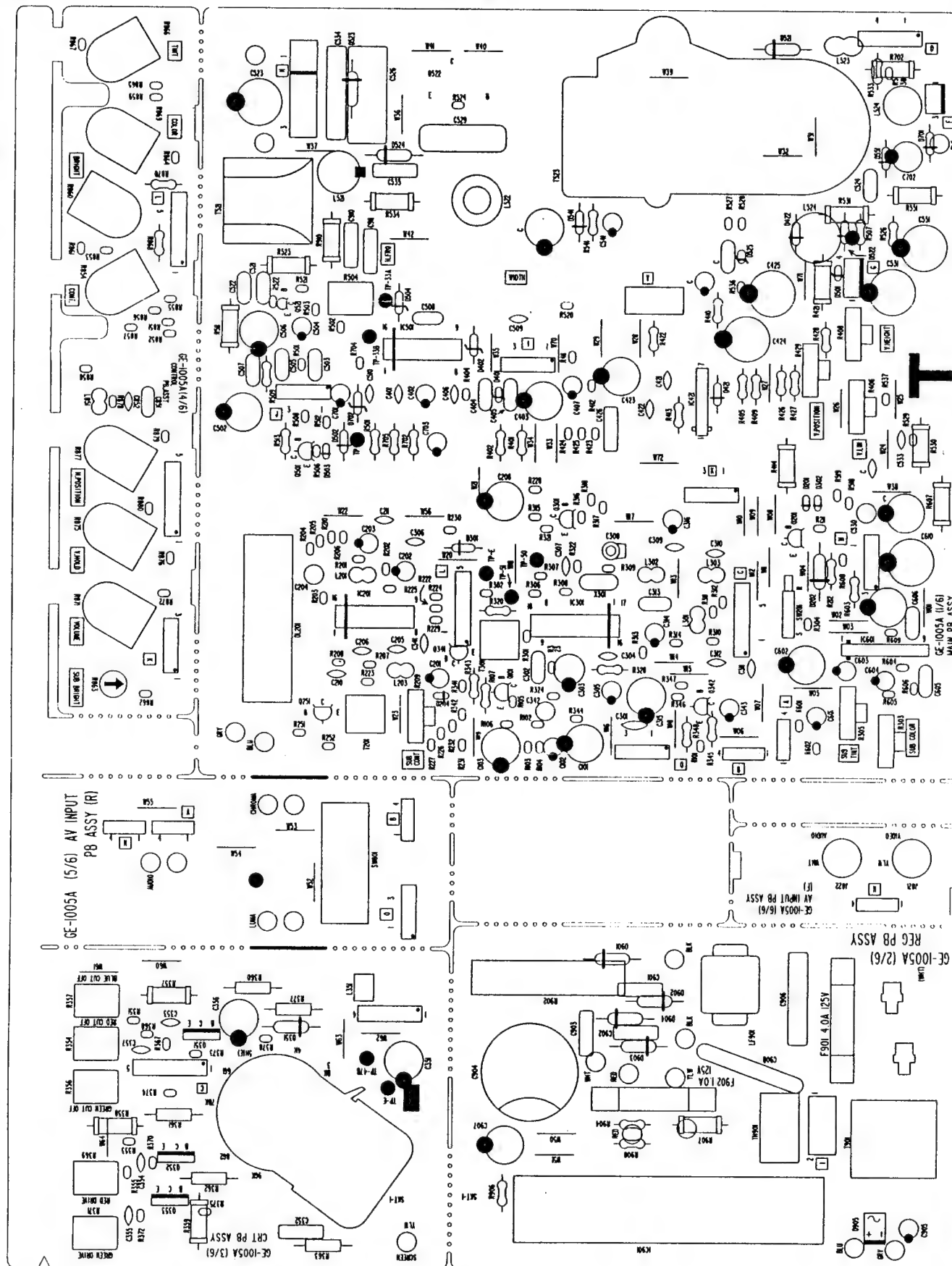
1701 Board Layout

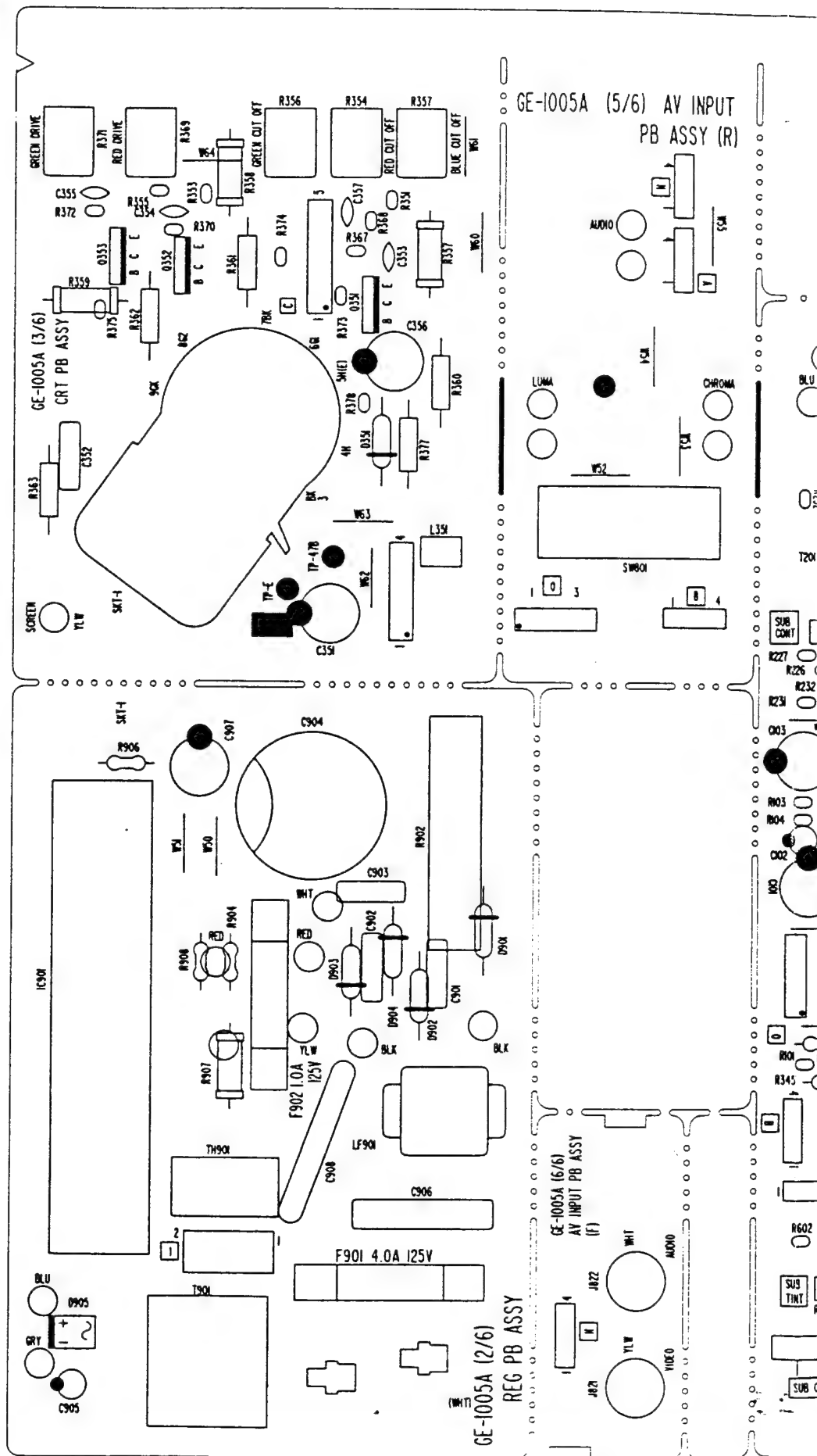




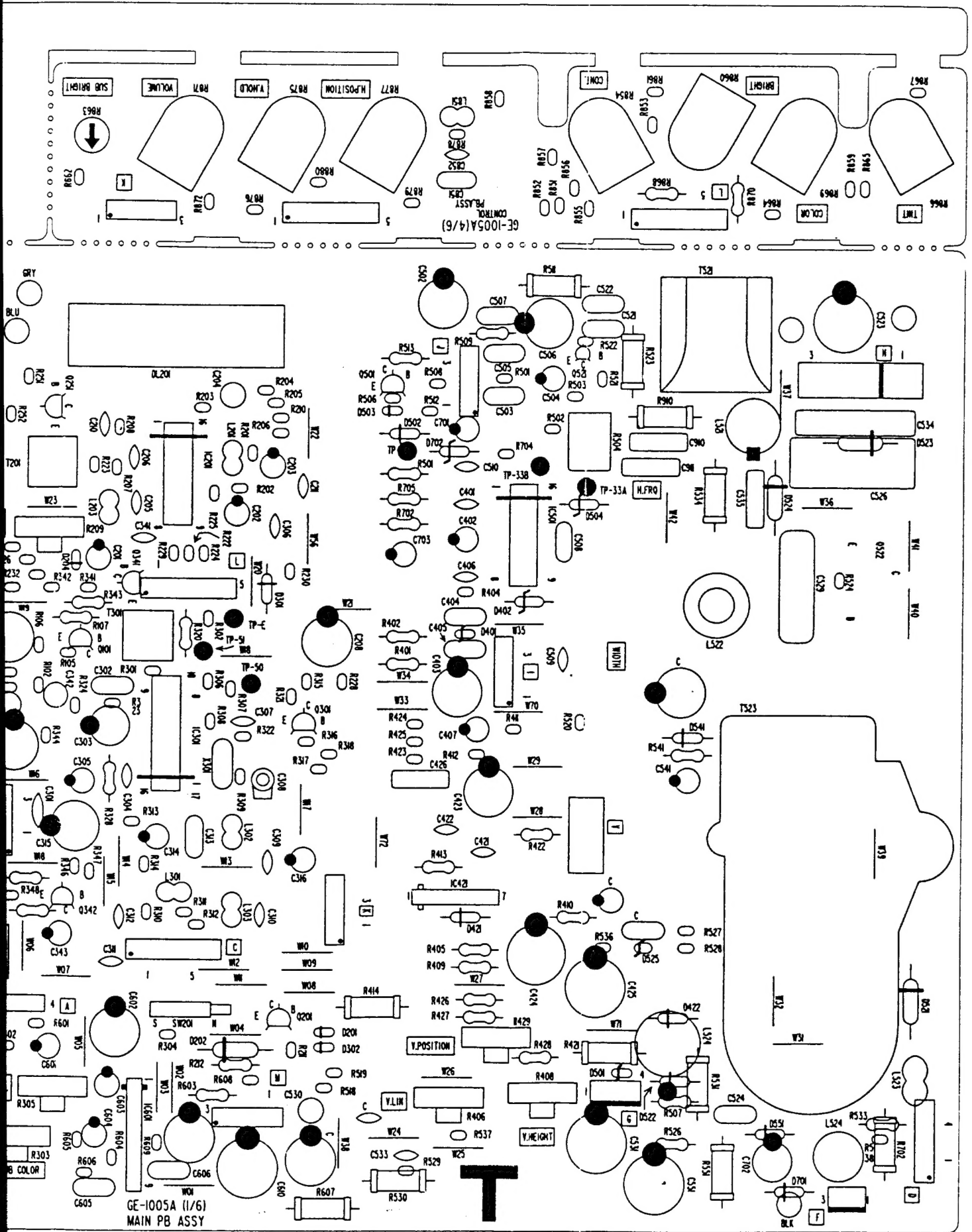


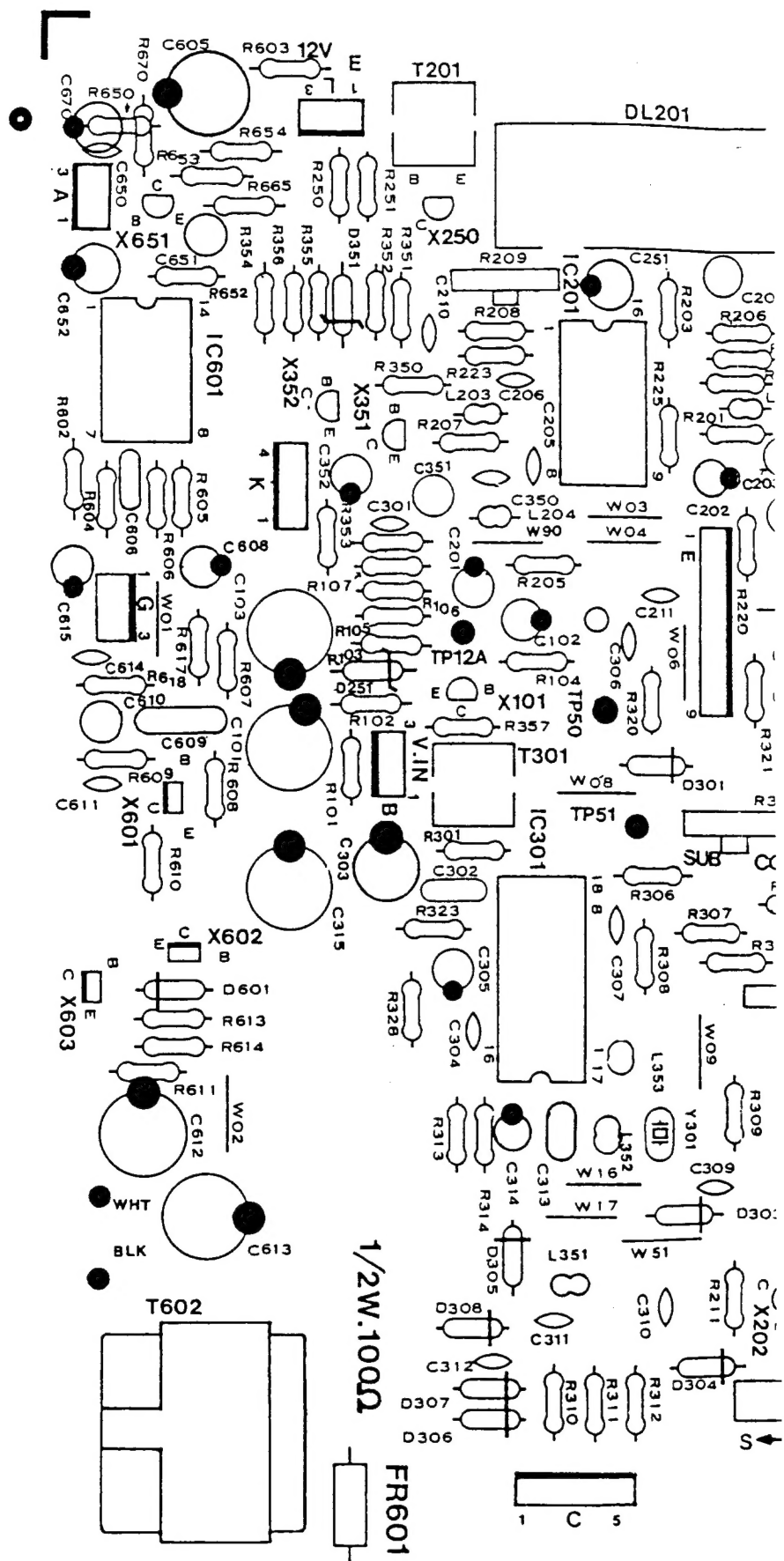






1702T Board Layout





GE-1000A

